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THE UNIVERSITY OF ALBERTA

THE EFFECT OF VARIATIONS IN SPATIAL DENSITY ON THE BEHAVIOR OF CHILDREN IN A GROUP DAY CARE SETTING

by

© Nancy Almira Dill

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled THE EFFECT OF VARIATIONS IN SPATIAL DENSITY ON THE BEHAVIOR OF CHILDREN IN A GROUP DAY CARE SETTING

submitted by Nancy Almira Dill in partial fulfilment of the requirements for the degree of Master of Education.

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Date September 4, 1980

ABSTRACT

The purpose of this study was to examine the effects of variations in spatial density on setting use, setting specific behavior and the types of social interaction behavior exhibited by children in a group day care setting. The theoretical basis for this study was derived from the interactionist position of man-environment relationships which describes the two as independent but mutually interacting systems.

Forty-three children in three rooms in an Edmonton group day care center were studied. The children ranged in age from 2.8 years to 5.9 years. The children in two rooms, Room A and Room B, were exposed to an experimental variation in the amount of space while the children in the third room, Room C, were used as a control group and no variation in space occurred in that room.

The children in the experimental rooms were observed for 10 days the regular spatial condition. During the following 15 days of observation, barriers were placed across the width of the experimental rooms and all furniture and equipment were placed in the compacted area. During the following eight days of observation, the barriers were removed and the children had access again to the regular space. With a group of twenty children, the density was 3.4 m^2/child in the regular space, and 2.7 m^2/child in the compacted space. During the data collection period, there were high levels of absenteeism and the density levels in Room A and Room B, when the regular space was available ranged from 4.7 to 8.2 m^2/child and when the compacted space was available ranged from 2.9 to 4.4 m^2/child. Density in Room C ranged from 4.5 to 6.6 m^2/child.

A room scan methodology was used to record use of space and behavior within the space. The rooms were divided into settings according to the materials available in each area and the behavior associated with each area. Four observers, who had been trained before the data collection began, reached inter-observer reliability levels of 91%. The observer scanned each room setting by setting at two-minute intervals and noted which children were in each setting, the type of activity and the type of social interaction in which they were involved on a grid map corresponding to the settings in each room. Observations occurred for an hour each morning during free play. Mean percentage and frequenty data was calculated for the children by group, sex and age for each density condition.

The findings indicated that the variations in behavior which occurred in the experimental rooms were similar to those in the control room. The behaviors studied do not appear to be differentially affected by density levels between 3.5 and 6.2 m^2/child. No information as to the effect of density levels higher than 3.5 m^2/child was obtained. Individual data showed greater variations than group data. The effect of density variations may have more impact on certain children than on others.

The coercive power of settings on behavior was indicated by a high percentage of setting specific behavior. Patterns of setting use followed those which had been established previously with males using the Block Area more than females, and females using the Craft Areas more than males. All children showed high levels of group social interaction, though younger children were involved in fewer group interactions than older children.

Findings were discussed in terms of their implications for further research and for day care practice. More information is needed to understand the complex relationship between man and the environment, though staff working in a day care environment may make use of the information already available in planning and organizing centers for young children.

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CHAPTER I

INTRODUCTION TO THE STUDY

A. Background to the Problem

The determination of human behavior has fascinated humanity for eons. For the past century attention has been focused on two variables which have been deemed responsible for the majority of human behavior. These two variables have been called by many names - heredity and environment, nature and nurture, experience and maturation - but they may be defined basically as internal, personal factors (heredity) and external environmental factors (environment). Controversy as to whether environmental or personal factors carried more weight in the determination of human behavior has led to studies of each factor separately with most of the emphasis on hereditary traits. Relatively little attention has been paid to environmental variables (Moos, 1974). The isolation of these two factors has led to an inaccurate understanding of the mechanisms behind human behavior. Environmental and hereditary factors have an interactive effect on behavior and neither can be separated from the influence of the other (Lerner, 1976). Individuals react in unique ways to the same stimulus yet there are many situations which seem to evoke behavior across individuals which is more similar than different. Gump (1974) studied environmental influences on behavior and concluded that personality differences were not the major determinants of behavior. The environmental settings which influence behavior then become a variable which it is necessary to examine to understand in greater depths the determinants of behavior. The purpose of this study is to in-

vestigate the effects of variation in one environmental factor, density, on children in a day care center.

The factors which influence the development of young children are of great importance. The early experiences of a child are generally acknowledged to be influential in later development. Bloom (1964) has stated that in terms of intelligence "about 50% of development takes place between conception and age four, [and] about 30% between ages four and eight "(p.88). Hunt (1961) has also determined that intellectual functioning is greatly influenced by the early experiences of the child.

White, Rubin, Attanucci, and Shapiro (1978) have examined extensively the environmental influences on children during their early years of development in an attempt to establish the forces which determine the development of competence. They have investigated the development of language, social skills, intellectual ability, and physical skills and have determined that environmental factors do play a role in early human development. More research in the area is a priority for White et al. as "the lack of studies of the influence of the environment on the process of development...prohibit[s] the full development of a mature science of human growth" (p. 88).

The importance of early environmental influences in social development has been examined by Lewis and Rosenblum (1975). They suggest that adequate opportunities for social interaction during a child's early years may "represent a setting that is quite conducive to substantially normal social development" (p. 7). Peer interactions were discovered to play a crucial role in the development of learning, imitation, and social skills.

The environment of a young child may have far reaching effects in terms of determining patterns of growth and development. A greater understanding of the ways various environmental factors affect the behavior of children would prove useful in planning the settings where children spend their time.

Social and economic trends have demanded that the environmental setting for many young children change from the family home or neighborhood babysitter to a group day care center. As a result of the trend for women to enter the work force in an unprecedented fashion, economic restraints which have made it difficult for families to exist on one income, and the increased rate of divorce which often leaves single parents the sole support of the family, the need for full-time day care has increased. In Canada, in 1979, there were 78,653 children registered in full-time group care programs (National Day Care Information Centre, 1979). Children in a full-time day care center may spend as many as eight hours a day, five days a week for several years in this environment (Kilmer, 1979). This constitutes a majority of the child's waking hours and must necessarily have considerable influence upon the child. It becomes imperative that the environment provided be of optimum quality to ensure that the child's growth and development are promoted to the greatest degree. To determine what factors are important in providing an optimum experience for these children requires investigation of the environmental influences on children in a day care center.

One factor of the environment which has been found to be influential in determining behavior is space. Feitelson and Ross (1973) have stated that the availability of sufficient space for children

to use play equipment is necessary for the emergence of play. Organization and complexity of space have been found to affect children's social interactions (Hoffman, 1976; Scholtz & Ellis, 1975). McGrew (1970), Loo (1972), and Rohe and Nuffer (1977) found that density of space affected children's social interactions and their use of space. It is this last variable, density, which will be investigated in this study. Research on the effects of different densities has taken place mainly in nursery schools, kindergartens or in experimental settings. There is a need for information about the influence of spatial factors in a day care setting.

Density, which may be defined as the amount of space available per person, has been considered an important variable when standards for adequate facilities for day care have been established. Government legislation provides minimum space standards which determine density levels in day care centers. These standards vary greatly according to the province or state in which they apply. At present there is no definitive research which defines an optimum ratio of children to space in day care. Several figures are advocated but they do not appear to have an empirical basis. The Child Welfare League of America (1972) advocates a ratio of 4.9 m^2/child (50 sq.ft./child) excluding bathroom, cooking facilities, stairs, halls or offices and recommends that the amount of playroom space per child should not be under 3.36 m^2/child (35 sq.ft.). The Canadian Council of Social Development (1973) proposes that 3.36 m^2/child be the absolute minimum space required in full time day care centers and that 4.8 m^2/child be the minimum for infants. They have suggested that 3.84 m^2/child (40 sq.ft./child) is more desirable ratio and one which day care regulations should gradually adopt.

A survey of the relevent literature in the United States (CSWR, 1977) found that the recommended minimum standards ranged from 1.92 m^2/child (20 sq.ft./child) to 5.70 m^2/child (60 sq.ft./child) with 3.36 m^2/child being the figure most frequently stated. It was found that there was no empirical evidence to support these standards and that the standards were primarily based on the opinions of professionals in related fields such as architecture, child development, and the social sciences.

In Canada, space regulations for day care are a provincial responsibility. The legislative requirements dealing with the amount of space per child, aged two to six years, in an indoor full time day care setting ranges from 2.4 m^2 (25 sq.ft.) in Manitoba and Quebec to 3.84 m^2 (40 sq.ft.) in Newfoundland (Mathien, 1978). In Ontario the legislation specifies that there must be one activity room for each 25 children between the ages of two and six, which indicates that group size has also been considered a relevant variable when determining quality of child care.

The regulations in Alberta allow a minimum ratio of 2.5 m^2/child (26.4 sq.ft./child) for every room used for playing, resting or sleeping (Government of Alberta, 1978). For purpose of subsidy the City of Edmonton requires a ratio of 3.36 m^2/child. The center where the study was located has a ratio of 4.3 m^2/child (45 sq.ft./child) in each room, well in excess of the minimum provincial requirements and closely approximating the optimal standards advocated by the Child Welfare League of America.

Massing (1979) used the room scan technique in an exploratory study of children's use of space in a day care setting. Recommendations which resulted from her research suggested that more data collected over

a longer period of time, and over several groups of children was necessary to obtain a more accurate representation of how children use space. The proposed study follows up on the recommendations made by Massing (1979).

In summary, a substantial number of children are enrolled in full time day care programs during a period of their lives which is acknowledged as having an influential effect on further growth and development. Environmental variables and, specifically, the amount of space allotted per child may be determinants of children's behavior. There are conflicting positions regarding the optimal amount of space per child and no definitive research has been produced which illuminates this problem. This study proposes to investigate the effects of variations in spatial densities on the behavior of children in a day care setting.

B. Purpose of the Study

The purpose of this study is to determine whether a variation in the spatial density experienced by children in a day care center will cause changes in their behavior. The effect of this variation will be observed for three aspects of child behavior:

1) the children's use of space as noted by the settings in the room in which they spend their time.
2) the children's social behavior as noted by the type of interaction in which the children are engaged.
3) the specificity of the behavior of the children to the setting and the materials and equipment located within the setting.

C. Definition of Terms

The following terms and the definitions which follow are used in this study.

Day care centre: "the licensed facility and program for the provision of care, maintenance and supervision within a dwelling unit for periods of more than three but less than 24 consecutive hours for children between the ages of three and six" (Government of Alberta, 1978).

Density: the ratio of amount of floor space to number of persons occupying that space.

Free Play: a period of time when the child is allowed to choose his activities from a range of materials which have been set up or organized by the teacher or room supervisor. The teacher may offer suggestions to groups or individuals but she does not restrict children from a free play activity. The teacher may set up special activities but does not insist on involvement, nor does she exclude children (except if materials or space is limited). The teacher helps with difficulties and provides behavioral limits: helps to resolve quarrels, stops disruptive behavior, helps direct diffuse behavior, helps an uncertain child into an activity (Hoffman, 1976).

Room Scan: a process wherein every setting in the day care playroom is systematically checked and the presence and activities of children is noted on a grid sheet. Room scans are conducted at two minute intervals, for one hour each day, during the data collection period (Massing, 1979).

Settings: an area of the day care room which can be distinguished from the other areas by the materials associated with it and the principle focus of the activities carried on it. There may be observable physical boundaries separating it from the other parts of the room (Massing, 1979).

Setting Specific Activity: the behavior exhibited by children is congruent with the expectations of the staff and the materials and equipment associated with a setting.

Spatial Density Change: a change in density where the group size is held constant while the floor space available is changed (McGrew, 1970).

Social Behaviors:

(i) Solitary - refers to a pattern of activity in which a child is at least one meter distant from any other person, and is not engaged in conversation with any other person.

(ii) Parallel - refers to a pattern of activity in which a child is within one meter of another person, but is not involved in conversation with any other person, or involved in a joint activity which requires co-ordination of two or more people.

(iii) Group - refers to a pattern of activity involving two or more persons whose behavior is co-ordinated, such that behavior of one person is dependent upon the behavior of another person. Conversation may or may not be involved.

(iv) Transition - the type of activity occurring when a child is moving from one part of the room to another. In the room scan, children are coded as being in transition in a setting

if, at the time of the scan, they are in motion in the setting with the apparent intention of passing on to another setting (Massing, 1979).

(v) Watching - refers to the activity of a child who during a free play period, has suspended his/her involvement in an activity, is not engaged in conversation with any other person, and appears to be observing an ongoing activity.

D. Research Questions

Research Question 1

Will the percentage of time spent in each setting during free play in a day care room differ according to density condition for:

1.1 the total group?

1.2 males and females?

1.3 older and younger children?

Research Question 2

Will the percentage of time spent in setting specific behavior and non-setting specific behavior during free play in a day care room differ according to density condition for:

2.1 the total group?

2.2 males and females?

2.3 older and younger children?

Research Question 3

Will the percentage of time spent in solitary, parallel, group, watching, and transitional activities during free play in a day care room differ according to density condition for:

3.1 the total group?

3.2 males and females?

3.3 older and younger children?

E. Assumptions and Limitations

It was assumed that the room scan technique was able to adequately represent the children's use of space.

Limitations that may affect the validity of the study are listed below:

1) Because the sample for this study was not chosen at random, generalization to other populations may be of limited value. The day care center where this study is located may not be considered typical of most day care settings.
2) The time that the children are observed in the contracted density condition may be of such a short duration that the children are unable to adapt to the new condition. The behavior that is observed may not be representative of that found in a setting in which the same density is continuous.
3) The room scan technique may not succeed in recording the important behaviors that change due to the change in condition.

F. Summary

The relationship between man and the environment has been acknowledged as an influential factor in the determination of behavior. The environmental setting for a substantial number of children during a significant portion of their early years is full-time day care programs. Environmental variables in this setting, and specifically, the amount of space allotted per child, may be determinants of children's behavior. At present no definitive research has been produced which illuminates

this problem, and conflicting positions regarding the optimal amount of space necessary per child have no empirical basis. Decisions as to the amount of space which will be available to children are now made on the basis of government regulations which are themselves based on indefinite research. This study investigated the effects of variations in spatial density on children's use of space, the specificity of their activities to setting, and their social interaction with the purpose of contributing additional information to the subject.

This chapter has outlined the need for research of the environmental influences on young children. The definitions used in this study were described. The research questions which are examined in this study were presented. The assumptions and limitations of the study were discussed.

In Chapter II, literature dealing with the theoretical and methodological background to the study is discussed. Chapter III outlines the design of the study. The results of the data analysis are presented in Chapter IV. In Chapter V, the conclusions and implications derived from the findings are presented and discussed.

CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature relevant to this study will be presented in Chapter II. Density is an environmental concept and the theoretical framework, derived from the field of environmental psychology and upon which this study is based, will be described. The research which deals specifically with the effects of the variations of density on young children will be reviewed in detail. Play behavior is a research variable frequently studied in regard to the environmental influences on young children. Research which outlines means of categorizing children's play and which presents characteristic traits of children's play will be discussed. Finally, studies which have utilized the room scan methodology as a means of mapping children's activity in preschool settings will be outlined.

A. Man and the Environment

The study of the effects of varying spatial densities on the behavior of children is an attempt to understand one way in which man and the environment influence each other. The discipline which investigates the interrelationships between man and the environment is known as environmental or ecological psychology (Barker, 1968; Ittelson, Proshansky, & Rivlin, 1970; Lee, 1976). The interrelationship between man and the environment has been conceptualized into three main positions. They are: man is a product of the environment, the environment

is a product of man, and man and the environment are inextricably interrelated and influence each other. Overton and Reese (1977) have presented three models which describe the different concepts of man environment relations:

1) Man is reducible to environment

   This model is based on the concept of human development as the process of man being shaped by his environment. It is a reductionistic perspective and it is also the basis of the behaviorist model where each piece of molar behavior can be reduced to discrete units which are responses to specific environmental stimuli. Ultimately all behavior is to be considered a function of the environment.

2) Environment is reducible to man

   The environment in this model ceases to be a concrete reality but to be merely a construction of man. The "psychological environment" which refers to the world as perceived by an individual becomes the central influence on behavior. The environment then is a subjective reality unique to each individual.

3) Man and environment are interdependent systems

   Man and environment are independent but react reciprocally to exert formative influences on each other. Man influences and shapes his environment and then, in turn, is changed by the environment which has been transformed (p. 236).

The conceptualization of man and environment as independent but mutually influential systems is viewed by Overton and Reese as the most useful model to study man-environment relations. It allows each variable to be studied independently but also acknowledges that an understanding of one variable is dependent upon the understanding of the other. Others

in the field of environmental psychology have used this model as a framework for their research. Ambrose (1977) states that "developmental change [in the indiyidual] is the outcome of continuous interaction between the individual and the environment" (p. 4). According to Lee (1976), "Man does not have a passive oneway relationship with the built or natural environment. He is an active, striving, seeking organism who can both select and modify his environment" (p. 4). Man influences his environment but, as well, because of the experiences he has with the environment man" is never quite the same at any successive moment in time" (Lee, 1976, p. 4).

The interaction effect in the model results from the dynamic interchange between man and his environment and the effects of one cannot be isolated from the effects of the other. This is consistent with the conceptualization of the nature-nurture debate developed by Anatasi (1958) which states that environmental and hereditary factors are both fully involved in providing a source of behavior and, therefore, they cannot function in isolation but must always interact in their contribution. This is also the basis of the Piagetian principle of equilibrium. "By focusing on how cognitive development allows the organism to adapt to its environment, to survive, we can understand the dynamic interrelation between the organism and its environment which provides a source of intellectual development" (Lerner, 1976, p. 160). Equilibriation is composed of two independent processes, assimilation, where new structures are integrated into existing structures, and accommodation, where the existing structures are altered to include new structures. Assimilation then becomes the process of changing the environment to fit the cognitive structure and accommoda-

tion involves changing the cognitive structure to fit the environment. This process, which is central to cognitive development, is based on the conceptualization of a dynamic interchange as the basis of relationship between man and the environment.

The reciprocal forces of man and environment are central influences on human development and it is essential to study this relationship in order to determine optimum environmental conditions. Ambrose contends that "social practice that is effective in preventing certain kinds of development or in promoting others cannot possibly be worked out without practical knowledge of man-environment interaction and its consequences for development" (p. 3). The focus of research on the relationship between man and the environment may lead to a useful theory which will enable planners, designers, architects, and others interested in environmental impact to organize environments such that the forces of the environment and the individual are in harmony and not in conflict.

It is the model of man and environment as interacting and mutually influential forces which will be used as a framework to discuss concepts of environmental psychology pertinent to the study of density.

B. Behavior Settings

In order to gather more information on the relationship between man and environment, Barker (1968) studied the behavior of individuals in a particular community. He determined that certain patterns of behavior were specific to certain milieus and that these behavior-milieu relationships remained constant over time. He defined these behavior-milieu relationships as "behavior settings". Each behavior setting has a non-behaviorial component which refers to space or milieu. It also

has a standing pattern or program of behavior which is considered appropriate to the milieu. The appropriate behavior pattern for a milieu may be called setting specific behavior. The behavior associated with the setting is not a characteristic of particular individuals involved. The influence of the setting in determining setting specific behavior is strong enough to override individual differences which accounts for the great similarities in behavior according to setting (Gump, 1974). This is illustrated when one observes the behavior of people in a specific setting, such as a theatre or a school classroom. While individuals manifest differing patterns of behavior, most will conform to the "standing pattern" of behavior and the similarities in behavior will be greater than the differences.

Barker has outlined factors which determine that the setting and the setting specific behavior are congruent. He suggests that there is an "essential fittingness" between the behavioral and the environmental components of a behavior setting and calls the behavior-milieu units synomorphs to indicate their similarity in structure. The factors which influence behavior-milieu synomorphy are:

1) Physical forces, such as the physical arrangement and size of rooms, and the distributions of furniture and equipment.
2) Social forces as manifest by authority figures or cultural and social norms.
3) Physiological forces such as those experienced when reacting to changes in temperature or light.
4) Physiognomic perception or perceptions of stimuli originating in the non-psychological milieu. Barker suggests that particular environments such as a football field or a gym encourage specific

behavior patterns, i.e. running, and that "these milieu features appear via perception to demand this behavior" (p. 30).

5) Learning of suitable behavior patterns in an overt manner, i.e. being taught appropriate behavior for specific places.

6) Selectivity by individuals which indicates that the individual plays an active role in choosing environmental settings, and in so choosing, indicates a willingness to conform to the standing pattern of behavior associated with it.

7) Selection by behavior setting such that behavior settings exclude persons whose behavior patterns do not conform to the standing pattern of behavior.

8) Finally, behavior influences milieu such that a particular setting will be modified to meet the requirements of a certain pattern of behavior. For example, even though sidewalks are numerous, the campus is lined with paths created by students walking on the grass. They were formed when the existing network of sidewalks did not meet the needs of the students to find the shortest path between buildings so new paths were created.

The relationship between environment and behavior, using Barker's concept of behavior settings, has been investigated in preschool settings. Shure (1963) studied the behavior of preschool children during free play in settings common to a nursery school program. She found that settings exerted an influence over behavior such that there was more setting specific behavior that non-setting specific behavior, the amount of setting specific behavior varied according to setting, and mobility and types of social interaction varied by setting. Use of settings was not random and indicated that subjects chose the settings in which they played.

All settings were utilized at different rates by males and females. Physical size of setting appeared to be related to use and to type and amount of social interaction. Shure's study indicates that characteristics of the setting (size and type of equipment) and characteristics of the subject (sex) are both important variables in determining behavior.

Featherstone (1974), also found that personal characteristics of the child, in this case ethnicity and socio-economic status, were important influences in determining use of setting.

Rose, Blank, & Spalter (1975) investigated the stability of children's play behaviors over a four month period and found that behavior remained relatively stable within settings but that there were lower levels of stability across situations. Cohen, Hulls, & Rhine (1978) investigated the influence of context on the activity level of young children. They found that activity level is influenced by the context in which children's play is situated. They also looked at children's play preferences, and found, in agreement with Shure, that children do have preferences for specific activities but pointed out that these preferences may be age related. Their findings suggested that a broader perspective than merely physical influence must be considered when studying the combined effects of preference and context and it was proposed that children may prefer settings which accommodate their own activity level. This is in accordance with Barker's suggestion that individuals select settings with the view that they can and will conform to the standing pattern of behavior.

The synomorphic quality of the component parts of the behavior setting is also manifest in the functional interconnectedness of the parts so that when any principle part of the setting is changed all

aspects of the setting are affected. This was demonstrated in a school classroom by Weinstein (1977). Physical changes were made to specific settings in the classroom and it was found that behaviorial changes were coincident with the setting changes. The influence of setting and changes in setting on preschool children's play behavior was also studied by Kinsmen and Berk (1979) when they manipulated two commonly found areas in a preschool setting. A barrier between the house area and the block area was removed. Behavior was recorded both before and after the manipulation. They found that the change in the environment produced significant changes in the children's play.

These studies indicate that the relationship between the child and the environment is not simply a one-way construction but instead it fits into the model proposed by Ambrose (1977) of being one of mutual influence. Characteristics of the environment and of the subjects are interactive in their determination of behavior.

C. Proxemics

The environment which one experiences on a daily basis consists of both inanimate and animate objects. Not only is there a relationship between the setting and the individual, but when the setting includes others, behavior becomes dependent upon the relationship and the spacing characteristics of the interaction between people. Hall (1966) has studied man's spatial relations and has named this area of study "proxemics". He suggests that the meaning that is attached to the position of one's body in relation to another is a silent language essential to efficient and accurate communication. The concepts which are derived from the study of proxemics include privacy, personal space,

territoriality and crowding. These four areas will be discussed with an emphasis on crowding as it relates to density.

Personal Space

Individuals have a perception of personal space which goes beyond the physical space the body occupies. Personal space may be defined as an area with invisible boundaries surrounding a person's body into which intruders may not come (Sommer, 1969, p. 37). Invasion of one's personal space by another causes discomfort and induces defense mechanisms which reinstate a personal barrier. When people are forced to stand close to one another in a crowded area, personal distance is maintained by avoiding eye contact and tensing muscles to indicate that the situation is not one in which to relax. Each person determines his or her own personal space according to characteristics that are related to both the setting and the individual. Factors which have been found to influence personal space are cultural and social customs (Watson & Grave, 1966), the nature of the interaction (Dosey & Meisels, 1969), the relationships between the interacting individuals (Little, 1965), the sex of the interacting individuals (Sommer, 1969(, individual personality (Canter & Kenny, 1975) and age (Fry & Willis, 1971).

Research in the area of personal space of young children has tended to focus on the development of children's concept of personal space. Fry & Willis (1971) found that adults attribute a far smaller area of personal space to children than to other adults, and that by the age of ten, children are reacted to as adults. Guardo (1969) found that eleven-year old children attributed meaning to the spacing of figures which indicated that personal space was a relevant concept to them. Guardo also found that there were sex differences in the spatial distances

between figures according to the interpersonal relationship attributed to the figures. Lomranz, Shapiro, Choresh & Gilat (1975) studied the spacing relations of three-, five-, and seven-year old children. They found that there were age and sex differences in the distance children placed between themselves. Three-year old children sat much closer to other children than the older children did. There was no difference for five-year old and seven-year old children. Children sat closer to girls than they did to boys.

Personal space is very much influenced by cultural and social norms and it appears that by the time children have reached the age of five social norms are beginning to influence spatial behavior.

Privacy

Privacy is closely related to personal space though privacy appears to be a mental construct, while personal space has physical manifestations. Ittelson (1974) focuses on two dimensions of privacy: the freedom from unwanted intrusion, and freedom to determine the time and place of communication. A violation of privacy may also involve a violation of personal space. Privacy is the optimum balance between the "information" which comes to a person and that which he puts out. How any individual defines "optimal" is contingent on the occasion, the location, and the others involved. It is strongly influenced by social norms and varies widely, both within and between cultures. The process by which we attain optimum levels of privacy is the basis for most human spatial behavior (Ittelson, 1974).

One factor which influences others perceptions of both one's personal space and need for privacy is age. Children have limited access

to privacy. It is considered acceptable to have children "on view" during much, if not all, of their day and in all situations. Very young children do not have access to private situations as their time and spatial use are controlled by adults. Wolfe (1978) has determined that the development of the concept of privacy is related to other developmental concepts such as a sense of identity. Within North American culture, as children grow older they require more privacy and their definition of privacy becomes more complex. Not only do they seek physical privacy but also psychological privacy. They seek to protect themselves against intrusion into personal thoughts and perceptions. Wolfe's research indicated that privacy is a relevant concept for children. Children seem to feel a need for privacy which may not have been taken into account when planning environments for children. Many "open-area" schools which tried to eliminate enclosed classroom spaces have begun to provide private spaces for children so they can control the amount of stimulation to which they are exposed at various times of the day. (Ittelson, Proshansky, Rivlin, & Winkel, 1974). Children, as well as adults, need to be able to control information input and output.

Territoriality

The concept of territoriality in humans is related to the maintenance of adequate personal space and the search for optimal levels of privacy. Territoriality may be described as feelings of possessiveness related to a specific part of the physical environment. Sommer (1964) suggests that, in humans, feelings of territoriality do not relate as much to physical space as to body space - the space one perceives is

necessary in order to be comfortable. This relates territoriality to Sommer's concept of personal space.

It has been shown that humans do show territorial behavior in that they select a physical space and mark it (Sommer). This physical space may range from a chair in a library to a house and surrounding yard. Each particular milieu has a threshold of privacy associated with it (Lee, 1976) which dictates the behavior of others in the vicinity. Sommer found that in a library situation an empty chair with books on the table in front of it was regarded as reserved and only when no other space was available would this territorial marker be questioned. Invasion of marked territory would be resisted with varying degrees of strength depending upon the situation. In a library that was crowded it would be acceptable behavior for a stranger to sit down next to another individual. This would not be considered appropriate in one's back yard and the same behavior would be met with considerable discomfort and resistance.

Peters & Bentzen (1977) define territoriality as an individual's identification with an area in such a way as to indicate ownership and the accompanying behavior which establishes this territory and defends it against intrusion. They found that young children in a nursery program spent 35% of their time in 10% of the space, and while within their preferred space exhibited more confidence in verbal exchanges with the teacher, more active interchanges with other children and were more accepting of other children than when outside the space. This indication of preferred space may be an artifact of the association of preferred resources to specific setting, and not an example of territoriality. Still the behavior associated with this preference for

setting may be an important factor in analyzing the relationship between behavior and environment.

Crowding

The concept of crowding is integrally related to density and, in fact, these two terms are often used interchangeably without reference to the distinct difference between the two. Density refers to a physical condition which involves some spatial limitation and is usually described in terms of a ratio of amount of space per person. Crowding, on the other hand, refers to an experiential state in which the limitations of the space are perceived by the individuals exposed to them and cause some discomfort. The word "crowded" itself has negative connotations and is perceived as unpleasant or even painful. Stokols (1972) states that "any instance of spatial limitation involves potential inconveniences - the restriction of movement or the preclusion of privacy, for example. These potential restraints, however, are not necessarily salient to the individuals occupying an area of limited space" (p. 275). In a situation where changes in activity or changes in social behavior in relation to changes in density occurred, one may infer that there were also changes in the perception of being crowded.

Crowding is closely related to personal space and territoriality, in that in a crowded situation one may feel one's personal space is being violated and that one's control over territory may be severely limited. Desor (1972) describes the condition of being crowded as one in which excessive stimulation is received from social sources. This definition of crowding is related to Ittelson's conception of privacy as an optimum level of information management. In a crowded

situation the ability to manage information input and output is much more difficult. A crowded condition limits the control one has over personal space, priavacy and territory.

Individuals will regard similar situations differently in terms of the degree of crowdedness. The variables which affect an individual's perception of being crowded include past experience, limitation of movement and behavior, social interference, arousal of competitive feelings, and physical discomfort or pain (Stokols, 1974; Proshanksy, Ittelson, & Rivlin, 1970). Crowding is a psychological phenomenon is only indirectly related to density. Desor (1972) studied the conditions under which college students judged a situation to be crowded and found that perception of crowding was related to architectural structures such as number of doors and windows, the shape of the room, and partitions and not changes in absolute density. As well, the type of activity engaged in influences one's criteria of crowding. A greater density would be tolerated at a cocktail party than in a library before the situation would be judged as crowded. Proshanksy, Ittelson and Rivlin propose that crowding is ultimately related to freedom of choice. "Crowding occurs when the number of people an individual is in contact with is sufficient to prevent him from carrying out some specific behavior and thereby restricts his freedom of choice" (p. 182). This relates the concept of crowding back to the dimension of privacy described by Ittelson as freedom to choose the amount and type of social interaction.

Proxemics as the study of man's spatial relations focuses on personal space, territoriality, privacy, and crowding. All of these concepts are closely related and they cannot be isolated from one

another. Density, as an objective ratio of amount of space per person, influences all of the proxemic concepts. Increasing density increases the likelihood of invasion of personal space, territory and privacy, and of the perception of being crowded. This will, in turn, encourage behavior which will remedy the effects of increased interpersonal contact. The relationship between density and the proxemic concepts is not always linear and it is mediated by both personal and environmental characteristics. Nevertheless, there is a relationship which needs to be investigated.

D. Density

The phenomenon of the rapidly increasing world population and of the increased urbanization has led researchers to investigate the effects of high density living conditions. Studies on the effects of high density conditions on rats found disruption in normal reproduction functions and maternal behavior patterns and the development of behaviorial abnormalities (Calhoun, 1962). Others, looking at the behavior of people in high density urban areas, found increased rates of crime, mental illness, and disease but there was no evidence of a causal relationship between high density conditions and social disorganization (Stringer, 1975). Experimental research on the effects of density on adults is sparse and the results are confounded by the novelty of the situation and the limited length of time that individuals are subjected to the high density condition.

One facet of the environment which influences children in group settings is the density of the group. The definition of density which will be used throughout this review will be the ratio of floor space to the number of persons occupying the space. Research on the effects of

varying densities on young children has increased substantially over the past decade. Hutt & Vaizey (1966) were the forerunners in this field when they studied the effects of differing densities on young children in a hospital playroom. Since then, numerous researchers have investigated this area in many different settings, using children's play and social interaction as the most frequent dependent variables. The main findings of the research to date will be presented here.

Because density involves the interaction of two variables - the number of individuals and the amount of space - either variable may be manipulated. McGrew (1970) differentiates between the two types of manipulations. Spatial density change involves the varying of the space available while group size is held constant. Social density change involves the space available being held constant and the group size varied. While the actual ratio of floor space to individuals may remain the same, social density change and spatial density change may influence behavior in different ways due to confounding effects of the actual variable that is manipulated. When social density is varied not only do individuals experience differences in the density but the deletion or addition of individuals in the setting may influence social interaction patterns. As well, differences in the absolute amount of space may influence the individual's perception of the environment and the behavior exhibited apart from the direct effects of the change in density. When research on the effects of varying densities is compared the distinction between these two types of density change must be considered.

As a means of simplifying the research in the area, the density levels which are used will be classified into three categories: High density will refer to density levels of 0 - 3.0 m^2/child (0 - 32 sq.ft./

child), medium density will refer to density levels of 3.1 - 4.5 m^2/child (33 - 48 sq.ft./child), and low density will refer to density levels of 4.6 m^2/child (49 sq.ft./child) and greater. Each density range will be symbolized by a capitalized letter in brackets, i.e. medium density will be indicated by (M). The studies will also be categorized according to type of sample and type of research involved.

Density Studies in Day Care Centers

Much of the research on the effects of variations in density on young children has taken place in preschool or nursery settings. Only one study has been located in a day care center. Rohe and Nuffer (1977) studied the effects of varying spatial density on twelve three-to-five-year old children in a day care setting. The dependent variables examined included the children's social interactions, their relationship with materials, affective reactions, use of play areas, and mobility between areas. Two density conditions, 2.9 m^2/child (H) and 5.8 m^2/child (L), were experienced by the children as well as two conditions of partitioning, one with and one without partitions. The variation in density was created by a moveable partition which divided the room in half. Each day the children were exposed to one of four variations in density and partitioning. Each child was observed for a minute, three times a day, with observations recorded every ten seconds. A level of inter-observer reliability of 80% was reached. Rohe and Nuffer found that increased spatial density significantly reduced the amount of co-operative and association behavior but only tended to increase aggression. They also reported that choice of activity was affected by density because the high density condition appeared to discourage selection of activities

requiring high concentration. The small sample size and the daily change in the condition presented to the children may have affected the validity of the results.

Density Studies in Nursery Schools and Preschool Settings

The research in nursery schools or preschool settings has utilized varying methodologies and focused on different variables. Bates (1970) investigated changes in social density, while McGrew (1970) and Smith and Connolly (1976) studied changes in both spatial and social density. Fagot (1975), Shapiro (1975), and Price (1971) studied many classrooms and used the actual density in each classroom as the independent variable without manipulating either the amount of space or the number of children.

Bates (1970) studied 20 two- and three-year old children in group sizes ranging from 10 to 30 children. Three density conditions were defined: 8.0 m^2/child (L) (10-15 children in the room), 4.9 m^2/child, (L) (17-24 children in the room) and 3.8 m^2/child (M) (25-30 children in the room). With increasing density, the percentage of interactions of a conflict nature increased. Other changes noted with increasing density were an increase in solitary play, a decrease in the size of play groups, and an increase in the amount of same sex play by females, and a reduction in the locomotor movements, and an increase in the size of play group by males.

The differing effects of spatial and social density on 20 nursery school children's spacing behavior was investigated by McGrew (1970). Two room sizes (100% and 80%) and two group sizes (100% and 50%) were used to produce four density conditions which ranged from

8.5 m^2/child (L) in the 100% space and the 50% group size condition to 3.7 m^2/child (M) in the 80% space size and the 100% group size condition. The floor of the nursery setting was marked into squares of .7m x .7m and each square contained some nursery equipment. Children were observed for four-thirty minute periods during free play in each of the four experimental conditions. The observer recorded observations of children's spacing behavior on standardized sheets corresponding to the nursery floor grid. To reduce the space available, benches and chairs were placed at one end of the room to form a barrier and all equipment was moved into the reduced area. To reduce the group size, half of the group were selected to play outside during the observation. It was found that at higher spatial densities the amount of contact between children increased and the amount of solitary behavior declined. When social density was increased, by maintaining the room size and increasing the group size, the amount of solitary behavior decreased but the amount of physical contact and close proximity remained unchanged. At the lower spatial density level of 50% group size (7.39 m^2/child)(L), children maintained greater proximity than would have been expected by chance. McGrew (1970) suggested that spacing of individuals is not at random. This conclusion is supported by that of Sommer (1969).

When McGrew examined the differences between social density and spatial density change, she concluded that differences in social density were more potent in eliciting adjustments in spatial use than spatial density differences. However, in these experiments when social density was manipulated there was a change of 50% in the group size, but when spatial density was manipulated, the room size changed by only 20%. This discrepancy may interfere with the conclusions drawn. Another

factor to be considered is that the highest density condition of 3.74 m^2/ child (M) might still be considered adequate according to the advocacy literature, and that no condition involved excess crowding.

Smith and Connolly (1976) carried out three studies utilizing a preschool program for three- and four-year olds set up for experimental purposes. They were interested in separating the effects of the amount of resources available from the effects of changes in spatial or social density. To identify various conditions they developed a symbol system where:

N = number of children

R_s = spatial resources or amount of space available

R_p = play equipment resources available.

Two types of density were investigated - spatial density (D_s) which was the ratio of number of children to spatial resources (N/R_s) and play equipment density (D_p) which was the ratio of the number of children to play equipment resources (N/R_p). Observations were made during two free play periods in the morning over three consecutive school terms. Each child was observed for 40 seconds and a running commentary was dictated into a tape recorder. The recordings were later transcribed and observations were categorized as group play, aggressive behavior, and rough-and-tumble play. Inter-observer agreement averaged 78% for the three categories.

In the first study, the behavior of children in two groups of different sizes was recorded. Although there were differences in group size, the amount of space (R_s) and the amount of equipment (R_p) varied with the size of the group so that the ratio of space per child (D_s) and the amount of equipment per child (D_p) remained constant. No

significant effects were found except for a decrease in rough-and-tumble play in the smallest group size-resources condition.

In the second study both spatial resources (R_s) and play equipment resources (R_p) were varied independently while group size remained constant at 24 children. For each condition of varying spatial density (2.4 m^2/child)(H), 4.8 m^2/child)(L), 7.2 m^2/child)(L) there would be one, two, or three sets of play equipment provided. There were no significant effects for group play or aggression but rough-and-tumble play decreased significantly in the highest spatial density condition.

The third experiment used variations in social density. A group of 10 children and a group of 30 children were observed in a constant amount of space producing a high density of 1.4 m^2/child (H) and a low density of 5.8 m^2/child (L). Equipment density (D_p) remained constant at one play set for each ten children. Results indicated a tendency for less group play and significantly more aggression for one group in the higher density condition.

Smith & Connolly, using the results from all three studies, concluded that there may be a threshold density of 2.4 m^2/child (H) in aggressive behavior. Rough and tumble play appeared to decrease when the density was lower than 4.8 m^2/child (L). In drawing these conclusions, Smith & Connolly are using results from data gathered under two different types of density changes. The second experiment which showed no change in aggressive behavior within the range of 2.5 - 7.2 m^2/child varied the amount of space while the third experiment which showed increased aggression at 1.4 m^2/child varied the number of children. Comparisons of social and spatial density must consider the other factors which influence behavior in each of these conditions and should not be

used as identical manipulations.

Density Studies in Natural Settings

Using a naturalistic approach and manipulating neither the number of subjects nor the total amount of space, Fagot (1977) compared children's behavior in five different preschool rooms. Three of the classrooms were in the Netherlands and had density levels of 1.2 m^2/child (H), and two of the classrooms were in the United States, and had densities of 2.3 m^2/child (H) and 10.5 m^2/child (L). All the children observed were four-years old. A checklist of play behaviors and social consequences was used as an observation guide. Inter-observer agreement levels of 90% were attained in a reliability study prior to data collection. There were no significant effects for on-task behavior, non-task behavior, physical aggression and verbal aggression. Children in the higher density Dutch classrooms interacted positively twice as much as the children in the lower density American classrooms. Factors which must be considered when evaluating these results include the differing cultures from which the samples were taken and the wide range between the density figures. As previously discussed, perceptions of space are a product of cultural norms and the behavior and the amount of personal space deemed appropriate differ between cultures. To compare Dutch and American preschools of differing densities without first ascertaining that there was no difference in preschools of similar densities does not preclude the possibility of cultural influence on the children in each setting. Fagot noted that due to crowded conditions, the programs in the Dutch preschools were quite different than the American ones, and free choice play was not possible. This in itself may affect the validity of the

results. Another factor to consider is the amount of space per child in the lowest density condition (10.5 m^2/child). This ratio may be so large as to inhibit social interaction between children.

When comparing the behavior of children in naturalistic settings there are so many variables which are not being controlled that, in order to present results of any validity, many samples must be examined with the hope that the variables which are being controlled will be maintained as a constant while the other confounding variables negate themselves. Five samples as in Fagot's research does not seem to be an adequate number to ensure valid results.

Shapiro observed children's behavior in 17 preschool classrooms with a population of 274 four-year old children. The behavior category examined was non-involvement which included deviant, onlooker, and random behavior. She found that in classrooms of densities less than 2.9 m^2/child (H) there was more deviant and on-looking behavior and in classrooms of more than 4.8 m^2/child (L) there was more random behavior. In all non-involved behavior occurred least in rooms with densities which ranged from 2.9 to 4.8 m^2/child (M).

Price observed 413 preschool and grade one children in 22 private and parochial classrooms. The rooms were divided into two groups, one group had a mean density of 0.9 m^2/child (H) and the other group had a mean density of 2.5 m^2/child (H). In the higher density condition, Price found an increase in solitary, non-interactive behavior and a decrease in social interaction. No difference was found in the amount of aggressive behavior.

Density Studies in Experimental Settings

Loo carried out a series of studies over several years on the effects of variations in density in preschool children. In each study, children, in groups of six, were exposed to two density conditions for one hour each. Each condition had the same amount and type of play equipment resources. Each group of children contained an equal number of males and females. Six observers were used to rate the six children. Each observer rated each child nine times during the observation period. In an initial study, Loo (1972) studied 60 children in 10 groups in density conditions of 1.4 m^2/child (H) and of 4.2 m^2/child (M). Each group experienced both conditions. The results showed that there was less aggression, less social interaction, more solitary behavior, and more play interruptions in the higher density condition. In a later study, Loo (1976) studied densities of 2.0 m^2/child (H) and 4.0 m^2/child (M). In the higher density condition Loo found more aggression, particularly for males, more avoidance behaviors, more passivity and onlooking, and more unstable behavior. For the lower density condition, there was more self-involved play where the children sat alone involved in their own toy activity. In the higher density condition children tended not to get involved in their own toy activity. Loo concluded that crowding prevents toy play while uncrowded conditions allow for prolonged toy activity. When comparing these two studies, Loo proposed that there may be a curvilinear relationship between density and aggression such that with increasing density, aggression increases until a threshold is reached, presumably between 1.4 and 2.0 m^2/child, whereupon aggression decreases. Loo suggests that given highly crowded conditions, children may become "catatonically" immobile.

Using the same methodology as in previous studies Loo (1979) again looked at the effects densities of 2.0 m^2/child (H) and 4.0 m^2/child(M) had on the behavior of children,and in addition, the perceptions of children. Using a process of factor analysis, five clusters of behaviors were produced and labeled Verbally Abusive Interaction, Activity-Toy Play, Avoidance, Negative-Affect-Aggression and Desire to Leave a Crowded Room. In the higher density condition, Loo found more Negative Affect-Aggression, which included factors of anger, distress, physical aggression, received verbal abuse, and lack of happy facial expressions. There was also more Verbally Abusive Interaction which included social interaction, verbal abuse and facing in towards the room. In the low density condition, there was more Activity-Toy Play which included movement around the room, toy-play, toy changes, walking, and onlooking. All the children were interviewed immediately after each play session to determine the children's perceptions of room attractiveness, interpersonal attraction to other children, and feelings of satisfaction, anger, fear, tiredness, and being crowded. Children in the high density condition liked other children less and felt more anger than those in the low density condition. Fourteen percent of the children in the high density condition felt crowded as compared to none in the low density condition. Loo suggests that because only a small percentage of children perceived the high density condition as crowded children may define crowding differently than adults, they may not know what crowded means or they may not have found that particular situation crowded.

From this study, Loo concluded that higher density conditions encourage negative effects in five-year old children such as more aggression, less toy play and less physical activity. It must be taken

into consideration that Loo studied children in an experimental setting using very small groups, and that each child only spent one hour in each condition. There is no evidence that these results may be generalized to children in larger groups or over longer periods of time.

Density Studies Using Abnormal Populations

Two studies on the effects of variations in density were conducted using samples which included children from abnormal populations. Hutt and Vaizey (1966) monitored the behavior of three- to eight-year old children classified as autistic, brain-damaged and normal in a hospital play room. Following up on Hutt and Vaizey's study, Loo (1978) attempted to determine whether variations in spatial density had differential effects on children who were categorized as high or low scorers on five behavior dimensions: 1) hyperactivity-distractibility, 2) anxiety, 3) hostility-aggressiveness, 4) behavior disturbance, and 5) motor inhibition. Both studies found that certain individuals who were categorized as abnormal in some aspect of their behavior manifest negative behaviors under higher density conditions. Hutt and Vaizey suggested that higher density conditions seemed to affect abnormal children to a greater degree than normal children. Loo concluded that children who may have behavior problems are not as well equipped to adapt to varying density conditions and are affected more by them than normal children. As a group of children in a preschool setting is interdependent, conditions which affect one segment of the group may also affect other members through association. Normal children who are not directly affected by high density conditions may be affected by their peer's reactions.

Summary

Researchers have studied the effects of density on preschool children using varying methodologies and looking at a variety of dependent variables. Observation techniques have been used most frequently in both naturalistic and experimental settings. The most prevalent behavior categories studied have been social interactions and agonistic behavior.

The general trend that is evident from the research on the effects of density on preschool children is that in higher density conditions there appears to be an increase in aggression and conflict situations and a decrease in social interaction. There also appear to be differences in the way males and females are affected by changes in density. These findings though are not universal and, in fact, some researchers have found little difference, or have found trends in the opposite directions. Obviously, more research is needed into the mediating factors that operate between the child and the environment. One factor which may have produced the conflicting results is the lack of consensus as to the definition of high and low density. In the studies reviewed, what is called high density may range from .9 to 3.8 m^2/child and low density from 2.5 - 10.5 m^2/child. The definitions overlap considerably, and as well, the differences within the high and low density conditions are larger than the differences between them. These factors make it difficult to determine an optimum density for children in preschool group programs.

Smith and Connolly (1976) state that the conflicting results may also be due to the manipulation of different aspects of the environment. They are particularly concerned with separating the effects of

density and the amount of resources available per child. Another problem which they point out is the lack of differentiation between aggression and rough-and-tumble play. Rough and tumble play can be distinguished from aggressive behavior by the presence of non-verbal signs such as an open-mouthed smile and laughter. Rough-and-tumble play would not be seen in the same negative context as aggression. Another criticism involves the confounding influence of environmental novelty when conditions are presented for short periods of time. The response children make to a new environmental condition may be influenced more by the novelty of the change than by the specific environmental alterations. Finally, Smith and Connolly suggest that many of the analyses of single groups of children fail to account for the dependent nature of children's behavior. "By definition, the members of the group are interacting; for example, one child may make others aggressive" (p. 204). More than one group should be studied and group rather than individual data should be used.

Some of the other factors which appear to mediate the effects of density on children's behavior include spatial organization, social relationships and territoriality. Shapiro (1974) notes that there are higher frequencies of random behavior where small amounts of space were allotted for activity areas. It was also found that lack of barriers between activity centers increased play distractions and large open space increased the frequency of random wandering. Rohe and Nuffer (1977) also found that introducing partitions into various activity areas increased cooperative behavior and, in high density conditions, markedly increased constructive behavior. McGrew's (1970) findings comparing the influence of changes in social and spatial density

caused her to conclude that social factors greatly affect children's spacing behavior. The concept of preferred space as demonstrated by Peters and Bentzen (1971), Shure (1963), and Cohen, Hulls, and Rhine (1978) also affect children's space behavior.

The effect of density on children's behavior is complex and mediated by other factors such as organization of space, amount and type of materials and equipment, social relationships and territorial identification. It appears that it might be important to maintain similar spatial organization and types and amount of equipment in the different density conditions, as well as to study more than one group of children over a longer period of time in order to obtain more information as to direct effects of spatial density variations on children's behavior.

E. Children's Play and Social Interaction

Social interaction is used in density studies as a measure of the effect of variations in density. Another area of research which has focused on the measurement of social interactive patterns in preschool groups are the studies of children's play. These suggest that there are several factors influencing social interaction such as age and sex of the children. These results appear to have implications for the relationship of spatial factors to social interaction.

Play is recognized as the means by which children explore their environment and themselves in order to learn the skills necessary to be fully functioning members of our society. The social interaction which occurs during play has been categorized and organized into a hierarchial structure according to the age range at which each type of play predominates (Parten, 1932). This indicates that environmental factors

may be influential in determining play behaviors, and, as well, influencing the developmental progress of the child.

Parten organized children's social play into four main categories: 1) solitary, 2) parallel, 3) associative, and 4) co-operative. Two non-play categories were also described, onlooker and unoccupied behavior. Solitary play as defined by Parten was exhibited by the child who played alone and independently in an activity different from those within speaking distance. Parallel play occurred when the child played independently but near other children. The child was involved in similar activities to the other children but was not involved with them. Parten divides group play into associative and cooperative play. Associative play involved the overt recognition by the group of their common activity. There was no division of labour or organization of the activity of the group. Co-operative play occurred when a group has organized for the purpose of reaching a goal. There may have been division of labour and the activity was organized so that the efforts of one child were supplemented by those of another. Unoccupied and onlooker behavior were similar in that they both involved a non-play condition and did not involve social interaction. Parten's study found that these play categories were organized in a hierarchial structure and that different play behaviors were more common at different ages. Solitary, described as the most immature stage, began to decline by the age of three or four as associative and co-operative play increased.

Follow-up studies have corroborated Parten's hypothesis that age affected social interaction, though they have not always agreed on the types and amount of play associated with each age group. Barnes (1971) replicated Parten's study and found significant differences between his

and Parten's sample in the amount of certain types of play. Others (Rubin, 1977; Rubin & Krasnor, 1979; Rubin, Maioni, & Hornung, 1976) question the developmental order of Parten's categories, particularly with regard to solitary play. Rubin, Maioni, & Hornung suggested that solitary play may be a means of controlling the amount of stimulation received. This has relevance to the previous discussion of privacy and crowding. In situations of high density where increased stimulation was likely, an increase in the amount of solitary play may indicate that children have developed the means to control information input and output. Both Loo (1972) and Price (1971) found an increase in solitary play in higher density conditions. Moore, Everston, and Brophy (1974) found that the activities most often associated with solitary play were of a goal oriented nature and were indicative of maturity and independence. They suggest that there is "a continuum of solitary play, in which children move from passively watching to involvement in more active and expressive activities to becoming independently involved in more challenging problem-solving activities" (p. 834). Solitary play is then seen as a normal and functionally beneficial activity rather than an indication of poor social adjustment.

Rubin, Maioni, & Hornung (1976) suggest that parallel play may be the most immature stage of social interactions. Parallel play may be indicative of a desire to be near other children and of a lack in the skills to develop a social relationship.

Associative and co-operative play categories seem to predominate as children reach the ages of five and six. Researchers have had difficulties in discrimination between the two categories on the basis of behavioral information and obtaining reliable results (Rubin, 1977).

In other studies co-operative and associative play have been collapsed and labeled group play (Rubin & Krasnor, 1979; Smith & Connolly, 1976).

As well as definite age differences associated with children's play, there also appear to be differences based on sex when the preference for type of play is studied. Several studies have found that boys prefer the block center and girls prefer the housekeeping center (Clark, Wyon, & Richards, 1969; Coates, Lord, & Jakabovics, 1975). Shure found that males preferred the block area and females preferred the art area, but that sex differences were apparent in the usage of all areas. Cohen, Hulls, and Rhine (1978) also found age differences in area preference and usage.

When studying the free play of children in a preschool situation, one might expect to find differences related to age and sex in the type of social interaction in which they engage and in the areas in which they prefer to play. Measures of social interaction during free play are valuable ways of studying children of preschool age. Lewis and Rosenblum (1975) support the value of social interaction between peers as important to social development and as having important implications for cognitive development. Studying the impact of the spatial environment in the social interactive behavior of young children may produce information which will help to provide an optimal learning environment for children in preschool settings.

F. Room Scan Methodology

To gather information about children's spacing behavior, McGrew (1970) and McGrew and McGrew (1972) developed a room scan technique similar to that used by ethologists to study spacing patterns of animals.

In McGrew and McGrew, the nursery area involved in the study was divided into squares of 2.2 m x 2.2 m. Some equipment was located in each square. Every two minutes, an observer would record, on standardized sheets corresponding to the nursery floor grid, the location of each child in the room. Primarily they noted the proximity of children to others.

The method used by McGrew and McGrew is adequate for noting the location of children within the room. It is difficult to obtain information relating to setting use and the influence of setting on behavior when the activities of the child are not related to specific areas such as activity centers.

Tyler (1975) used a similar instrument to record children's interactions with the environment, but divided the rooms into settings which were defined by the activities which occurred in each area. Every five minutes the observer recorded the number of children present, the sex of each and the interaction of each on a corresponding room map.

Neither McGrew and McGrew nor Tyler state the means of establishing reliability for the methodologies used, nor the level of inter-observer reliability.

Massing (1979) used the room scan methodology as developed by McGrew (1970) with modifications based on Tyler's methodology, in a day care center to gather information about the location of children, their involvement in setting specific or non-setting specific behavior and their social interaction. Her observations were recorded every two minutes on a room scan map corresponding to the room scan map with the room settings. Massing, using data obtained simultaneously by two observers, indicated that a level of inter-observer agreement of 89%

was reached. The major flaw in the methodology used by Massing was that each child was coded only once during each scan. This did not give an accurate description of the setting use patterns exhibited by the children, and specifically the make-up of the peer groups chosen for play mates which was an important aspect of her study. As the present study did not focus on the specific identity of those with whom social interactions occured, this flaw did not alter the validity of this methodology for this study.

G. Summary

The relationship between man and the environment has been conceptualized in three ways. The interactionist model where man and the environment are independent but mutually influential systems is the perspective which was selected as the theoretical framework for this study. Characteristics of man and the environment interact to influence behavior, therefore when behavior is studied both environmental and personal variables must be monitored. Barker's model of behavior settings was presented as an example of a conceptualization of man environment relations based on the theoretical framework.

The interaction between man and the environment includes man's relationships with man within the environment as well as man's relationship with the physical setting. The basic concepts of proxemics, which deals with man's interpersonal spacing behavior, were presented. Concepts of personal space, privacy, territoriality and crowding were outlined with an emphasis on crowding as it relates to density.

Studies of the effects of density on young children were reviewed. The studies focused on children between the ages of three and six and were located mainly in nursery school and other preschool

settings. Density levels used as independent variables ranged from 0.9 to 10.3 m^2/child, with the majority falling within the range of 2.0 to 5.0 m^2/child. Factors which were studied as dependent variables could be categorized basically as social behaviors and agonistic behaviors, though use of space, activity involvement, and proximity to others were also examined.

The effect of density variations was most frequently measured by observing individual children in preschool groups in more than one condition, and thus using each child as his/her own control. Manipulation of social density, spatial density or both were used to produce variations in room density. Other researchers studied numerous intact groups of children in classrooms of various densities in order to avoid the problems which occurred when experimental conditions were imposed. A general trend in the results suggested that higher density conditions produce negative responses in children, and different reactions to differing density conditions were found in males and females. Several researchers found no difference in the effects of variations in density, and others found that low densities produced negative behaviors. Much of the research suffered from methodological faults. More research which controls the mediating effects and corrects some of the methodological faults is needed.

Most of the research on density has used the behavior of children during free play periods as a dependent variable. Studies of children's play were reviewed, and children's social interactions, activity preferences, and use of play settings were found to be linked to age and sex variables.

Room scan methodologies have been successfully used to note children's use of space and behavior within the space.

CHAPTER III

THE DESIGN OF THE STUDY

This chapter will outline the design of the study. Information will be presented on the setting where the research was located and the children who were studied. Other areas which will be described are the instrumentation, the data collection process, and the method of data analysis.

This study was designed to determine if changes in children's behavior occurred as a result of changes in an environmental factor, density, and if these changes could be measured by a room scan technique.

A. Research Design

The design used in this study is quasi-experimental and involves repeated measures taken on two experimental groups and one control group. The subjects in each group were not randomly assigned but were in pre-formed groups.

In the experimental rooms, density was the major independent variable. By manipulating the amount of space available to the children in the child care room, the density within the room was changed. The data collection period was divided into three sections - Time One involved no change of space, and was the original spatial arrangement, Time Two involved a reduction in the amount of space available to the children, and in Time Three, the amount of space was returned to the original spatial arrangement.

Other independent variables which were used as a basis for comparison were group (by room), sex and age. Comparisons were made based on measurement of time spent in each setting, in setting specific and non-setting specific behavior, and in social interactive behaviors exhibited by children during free play.

B. The Setting

The day care center chosen for this study is a non-profit public day care center in the City of Edmonton which serves approximately eighty children. The center was considered appropriate for several reasons. One of the most important factors which made this location suitable for research was the size and similarity of the child care rooms. Four rooms, almost identical in size and configuration, were used to accomodate four groups, each with twenty children. Of the four rooms, one was eliminated from the study because of staff vacations during the data collection period which was considered to have a potential confounding influence on the children's behavior. Table 1 outlines the dimensions of the three rooms used in the study. With 20 children per group, which is the maximum allowed by the City of Edmonton regulations, the density for each room is 4.9 m^2/child. This figure is based on the total area in each room. When only the uncovered space is considered the density increases. Uncovered space refers to all the space which is not covered by furniture or equipment. Only furniture or equipment which prevents use of the space it covers would be considered. Cupboards would be included but not tables and chairs. The area of each room when uncovered space is considered is shown in Table 1. For a group of 20 children the average density in the rooms studied would be 4.3 m^2/child, which would be categorized as medium density. This figure is only slightly less

than that considered optimal by the Child Welfare League of America. It also allows for considerable variation in the amount of space available without violating the provincial standard of 2.5 m^2/child.

Table 1

Dimensions, Area, and Density of Day Care Rooms, Original Space

	Room A	Room B	Room C	Average for all rooms
Dimensions (meters)	13.6 x 7.2	13.6 x 7.2	13.6 x 7.2	13.6 x 7.2
Area (m^2)	97.9	97.9	97.9	97.9
Covered Space (m^2)	10.3	12.2	11.9	11.5
Uncovered Space (m^2)	87.6	85.7	86.0	86.4
Density for 20 children (m^2/child)	4.4	4.3	4.3	4.3

The similarity of the child care rooms in terms of size, spatial arrangement, amount of equipment, staff-child ratio, and staff qualifications facilitated comparisons between rooms.

Other factors which influenced the choice of this center included the organization of the settings within the rooms as physically distinct from one another which facilitated the setting by setting approach used in the room scan. As well, the use of settings was planned such that specific behavior was considered appropriate in each setting according to the materials and equipment present. This organization made the concept of setting specific behavior a viable one to study in the center. Another factor considered was that the center practises family grouping within rooms which enabled comparisons between age

groups to be made. Massing (1979) had used the same center as a location for her research and found it an appropriate setting for this type of research. As a follow-up study to Massing's research, it was considered that this location would be appropriate for the study. Finally, the staff was prepared to be involved in the study and bear the necessary inconveniences.

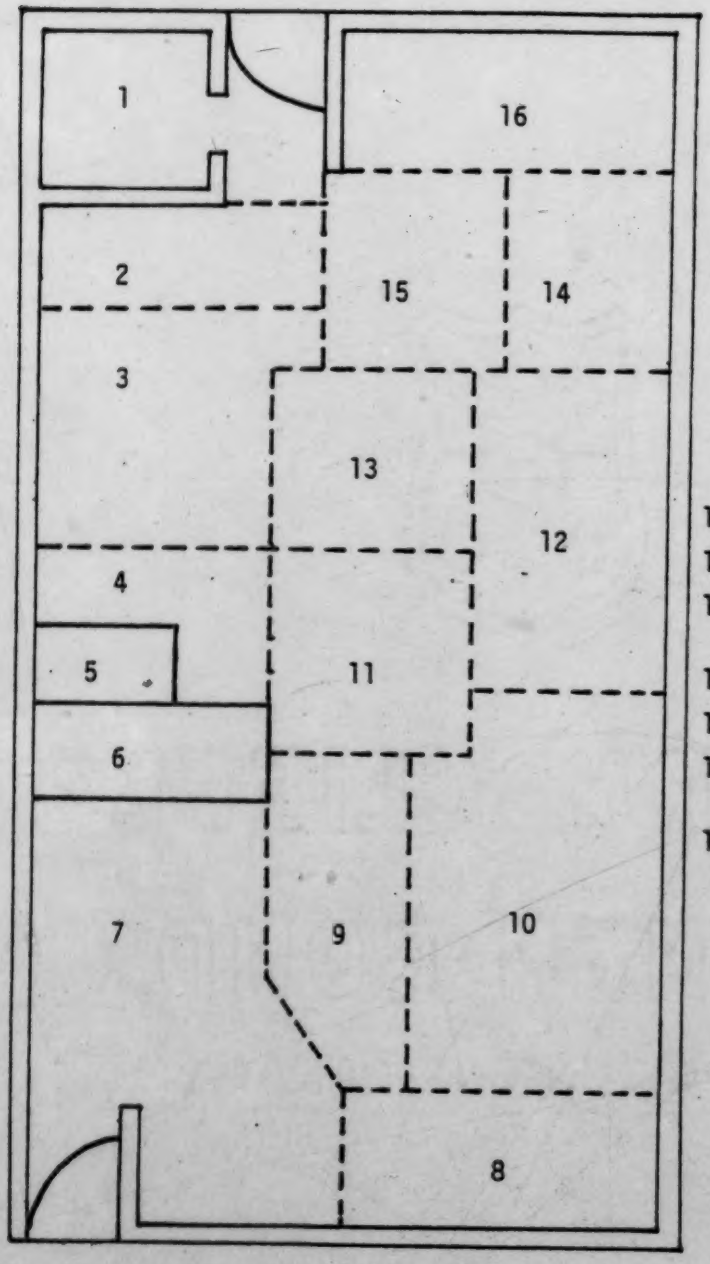
The staff for each room included a room supervisor, a full-time child care worker and a half-time child care workers. During the data collection period the room supervisor or the full-time child care worker was present. It was also common to have the half-time staff member with either one or both of the full-time staff working in the room. The maximum child-staff ratio varied from 20:1 to 20:3 during the data collection period. The staff members were all trained in the area of child care with varying amounts of experience. In Room A, the supervisor had had four years of nurses' training plus additional courses in child care, and had worked at this day care center for eleven years. Her assistant had a two-year diploma in social services and had ten years of experience in child care positions, two of which had been at this center. The half-time staff member in Room A had a two-year diploma in child care and was in the process of completing an education degree. She had worked in the center for one year. In Room B, the supervisor had a four-year teaching certificate, and nine years of experience in day care and kindergarten. She had worked at this center for four months at the time of data collection. The assistant had a two-year teacher training certificate as well as additional courses in child care, and had four years of experience at this day care center. The half-time staff member had a course in child care and five years experience in this center.

In Room C, the supervisor had university training as a nursery nurse and twenty-one years of experience in day care, eleven of which had been at this center. The assistant had graduated from a two-year child development course and had worked at this center for one year. The half time staff member in Room C had taken courses in child care at university and had worked at this center for eleven years.

Each room contained a similar amount of equipment and materials though the arrangement of each room varied slightly. Room scan maps of the study rooms indicate the organization of the settings within each room. Room A (Figure 1) and Room B (Figure 2) were organized into sixteen settings while Room C (Figure 3) had fourteen settings. As most of the settings were similar in each room, they will be described jointly. Settings which were unique to a room will be described separately. Reference to setting will be noted by the setting number following a room letter which corresponds to the room scan maps, i.e. the Block Area in Room A will be identified by Room A(7). A description of the settings and the material associated with each follows:

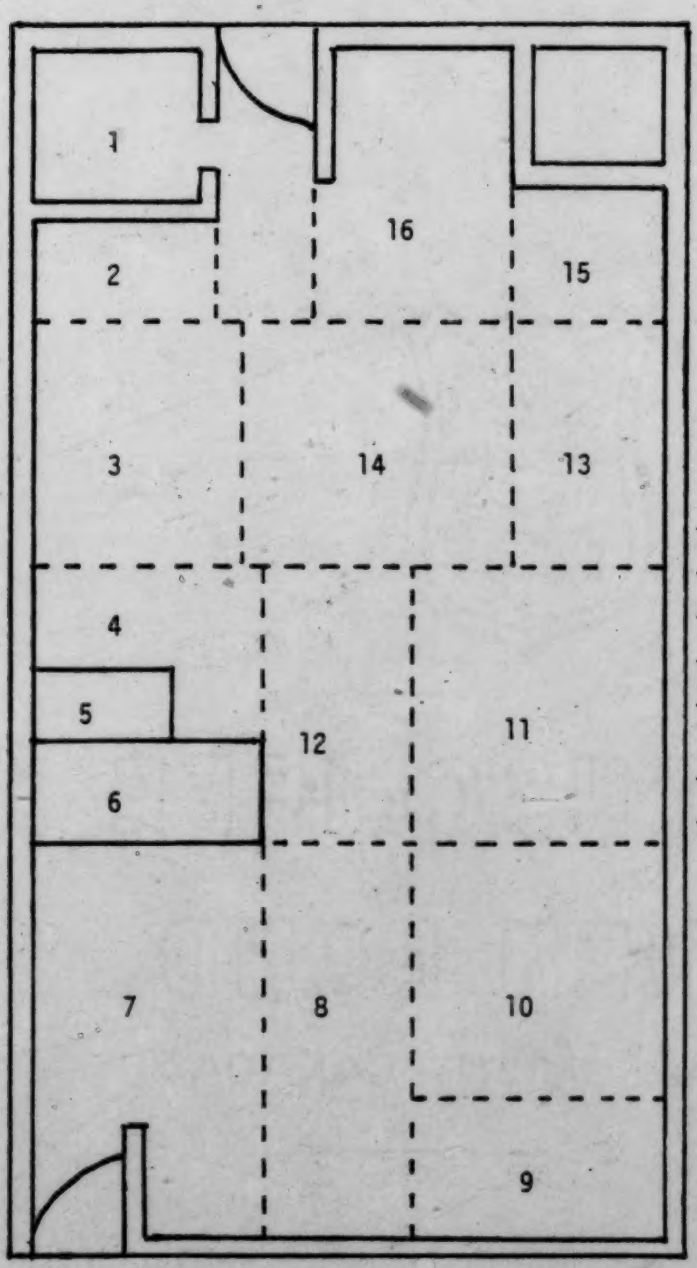
(i) Bathroom/Hall - Room A(1), Room B(1), Room C(1)

Each room contained a bathroom area, which was adjacent to a passage hall which led from the main hallway in the day care center to the play area in the child care room. In Room A the bathroom area was shared with the adjoining child care room. It contained four toilets, four sinks, and four mirrors. In Room B the bathroom area contained two toilets, two sinks, and two mirrors. The bathroom area in Room C contained two toilets. The hall area in each room contained a small bench which was used by children waiting to go to the bathroom



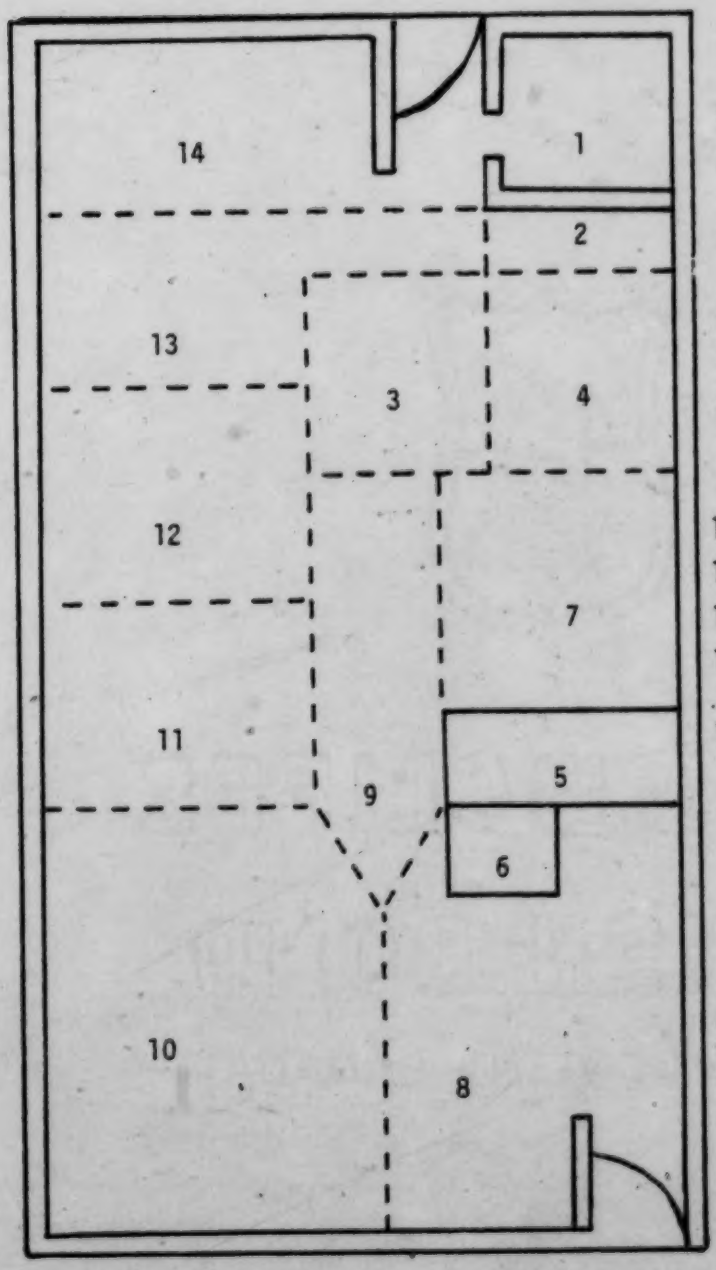
1. Bathroom/ Hall
2. Water Table
3. Craft Area 'A'
4. Under Loft
5. Little Loft
6. Big Loft
7. Blocks
8. House
9. Felt Board
10. Music/Book
11. Table Toys
12. Sand Table/ Storage
13. Paint Easel
14. Puzzle/Snack
15. Craft Area 'A'
16. Teacher Storage

Figure 1. Room A in regular condition.



1. Bathroom/ Hall
2. Water Table
3. Craft Area 'A'/Snack
4. Fisher-Price Toys
5. Little Loft
6. Big Loft
7. Block
8. Access
9. House
10. Music/Book
11. Table Toys
12. Access/Chalk
13. Playdough
14. Craft Table 'B'
15. Sand Table
16. Teacher Storage

Figure 2. Room B in regular condition.



1. Bathroom/ Hall
2. Sink
3. Craft Area 'A'
4. Craft Area 'B'
5. Big Loft
6. Little Loft
7. House
8. Blocks
9. Table Toys
10. Music/Book
11. Small Blocks
12. Scrap Table
13. Natural Materials
14. Snack/Craft Area 'C'

Figure 3. Room C in regular condition.

or to put on shoes.

(ii) Water Table - Room A(2), Room B(2), Room C(13)

A water table and appropriate water play accessories were located in each room. In each room, only two children were allowed to use the water table at a time. In Room C, the carpentry table and a sand table were located in the same setting. The sand table was covered throughout the data collection period. The carpentry bench contained tools such as hammers and saws as well as nails and scraps of wood.

(iii) Little Loft - Room A(5), Room B(5), Room C(6)

The little loft was a platform approximately one meter squared in size and one meter off the floor. In Room A, the doctor kit was generally located here. In Room B, Fisher-Price buildings were found on the little loft. In Room C, no equipment was located in this setting.

(iv) Big Loft - Room A(6), Room B(6), Room C(5)

This setting was a platform two meters square in area located 1.5 meters above the floor. The area was bounded by a railing made of wood and rope approximately .5 meters high. Access to this area was obtained by ladder or by climbing up from the little loft. In Room A, Fisher-Price buildings and Lego blocks were located in the big loft. In Room B, hand puppets and soft pillows were found in this setting. A Fisher-Price castle was found in the big loft in Room C. Access was limited to two or three persons at a time.

(v) Block Area - Room A(7), Room B(7), Room C(8)

In each room the block area was the largest setting. It contained wooden building blocks, large plastic blocks, and interlocking plastic pieces which could be put together to make play structures. As well trucks and toy vehicles were also located in this area. In

Room B and Room C, hats such as firemen's helmets, and construction hats were found in this setting as well.

(vi) Craft Tables - Room A(3)(15), Room B(3)(14), Room C(3)(4)(12)(13)

Each room had several areas set aside for craft activties. Basically there were two types of craft tables - those where the crafts were initiated by children and those where the crafts were initiated by staff members. Settings in Room A(15), Room C(14) and Room B(3)(4)(13) contained tables which were normally set up by a staff member with a craft activity. The craft tables located in Room A(3), Room B(3), and Room C(12) were located near storage cupboards where scrap materials and craft supplies were stored. Children had access to scissors, glue, paper, and scrap materials. Crafts in these settings were usually child initiated.

Two of these areas were also used for snack. In Room A(13) another table was located and was used exclusively for snack. In Room B(3) the craft table was cleared for snack, and after snack, it became available for craft activities again.

(vii) House Area - Room A(8), Room B(9), Room C(7)

Each housekeeping area contained the same type of equipment. Child sized kitchen appliances, tables and chairs, cupboards, doll beds and buggies were located in this setting. Dress-up clothes could also be found here. The organization of each house area varied from room to room. In Room A it was located in a corner of the room, with the two open sides bounded by cupboards. In Room B, a Wendy House frame formed the front and two sides of the house. A door and windows were cut into the frame. The back was bounded by the room walls. In Room C, the house area was located underneath the big loft and bounded by cupboards.

(viii) Music/Book Area - Room A(10), Room B(10), Room C(10)

In each room, the music/book area was the second largest setting in the room. Each setting contained a record player and a selection of story and music records. Story books were also located in this area. Small benches and a large rocking chair were available for seating. In Room B, this area also contained rhythm band instruments and storage boxes for children's work. In Room C, a television set was also located in this area, though it was never in use during the data collection period.

(ix) Table Toy Area - Room A(11), Room B(11), Room C(9)

The table toy area was generally bordered by shelving units which contained manipulative toys, lego blocks, small building blocks, puzzles, tying and buttoning frames, and magnetic letters. Children had access to these materials and could use them during free play activities.

Settings Unique to Room A

(i) Under Loft Area - Room A(4)

This included the area underneath both the little loft and the big loft as well as the area adjacent to them on one side. One side of this area was bounded by a partition that extended up to the big loft. Two chairs and a bench were located in this area. It had been set up as an area to play "office."

(ii) Felt Board Area - Room A(9)

An easel covered with felt was set up in this area. Felt backed story characters were available from trays on the easel for the children's use.

(iii) Sand Table/Storage - Room A(12)

The sand table remained covered during data collection. This area was used most often as a place to dry art projects. Storage of beds was also located in this area.

(iv) Paint Easel - Room A(13)

The easel was set up with paper and paint. Two children could paint at the same time.

(v) Snack/Puzzle Area - Room A(14)

In this area there was a table hinged to the wall. The setting served a dual purpose. A puzzle storage tray was located on the table and it was used as a puzzle table occasionally. Primarily, it was the table on which snack was served.

(vi) Teacher Storage - Room A(16)

This area contained storage cupboards which held supplies and equipment generally accessible only to the staff. Occassionally a child would be seated in this area to isolate him/her from the other children.

Settings Unique to Room B

(i) Under Loft Area - Room B(4)

The area underneath the big loft and the little loft, as well as the area adjacent to them was included in this setting. Two small tables with doll houses on them were located in the setting. One side was bordered with a table in which the guinea pig cage was set. The other side was bordered by a partition which extended up to the big loft.

(ii) Access Area - Room B(8)

This long, rectangular shaped area was used primarily as a

means of access to the other settings around it and occasionally as a spillover area from the settings adjacent to it.

(iii) Access/Chalk Area - Room B(12)

This area was used basically as a transition area between settings. A small chalkboard was set upon a table on the perimeter of this area.

(iv) Playdough Table - Room B(13)

This setting included a table attached to the walls by hinges and four chairs. It was primarily used for playdough and other modeling materials.

(v) Sand Table - Room B(15)

A sand table was located in this setting as well as materials appropriate to sand play. Two chairs were located in front of the sand table, and play in this area was limited to two children.

(vi) Teacher Storage - Room B(16)

This area contained storage cupboards which held supplies and equipment generally accessible only by the staff. Beds were also stored in this area.

Settings Unique to Room C

(i) Sink Area - Room C(2)

This setting was a rectangular area in which two sinks were located. There was also a mirror, and the area was used to store children's towels, combs, and toothbrushes. Teacher storage cupboards were located in large cupboards at one end of this setting.

(ii) Small Block Area - Room C(11)

This area was bounded by three low shelving units and a wall.

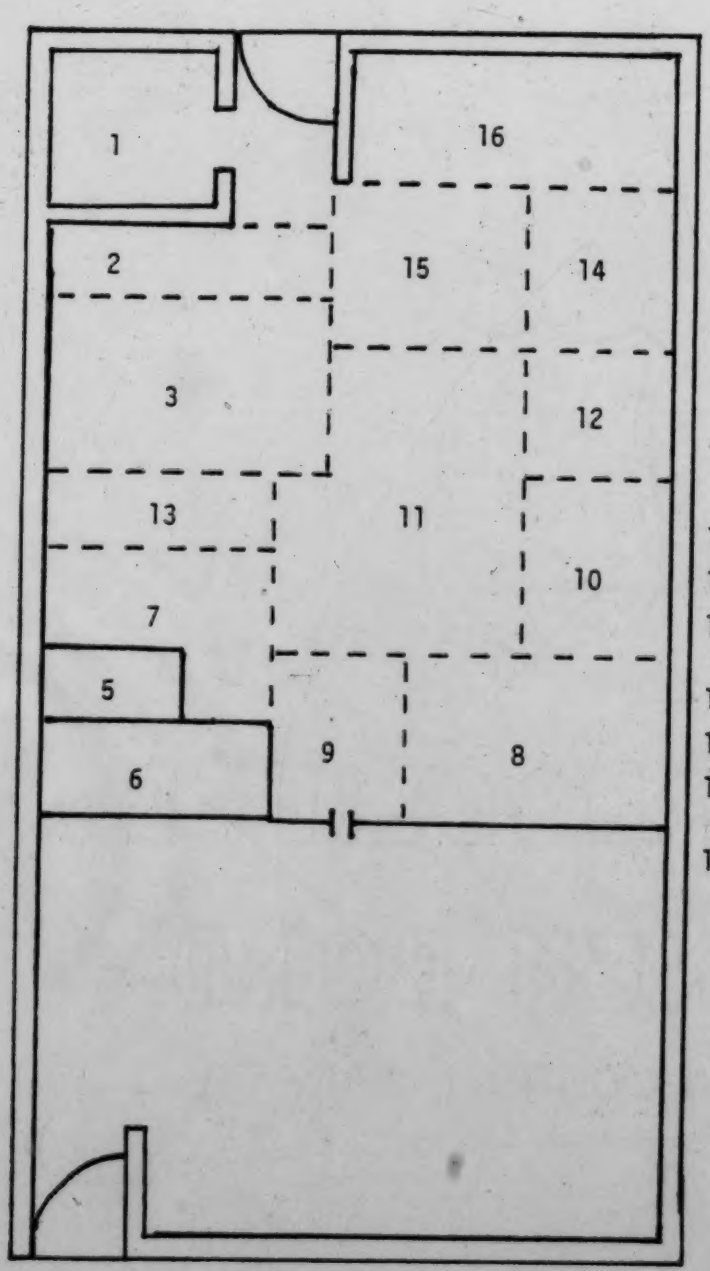
Small building blocks were located in this area as well as a toy garage and farm set. The guinea pig cage was set on a cupboard separating this setting from the scrap table.

Compacting the Rooms

Following the data collection under the regular spatial arrangement in Time One, the space in Room A and Room B was compacted. The room scan maps used in these two rooms shows the oranization of the settings in the compacted condition, Time Two (Figure 4, Figure 5). In general, all equipment was moved into approximately half of the child care room and screens were placed across the width of the room to represent a new external boundary. Access to the outside play area was left in accordance with fire regulations. In the compacted condition every effort was made to ensure that the amount of equipment and the resources were maintained as well as the configuration of the room and the relative location of the settings.

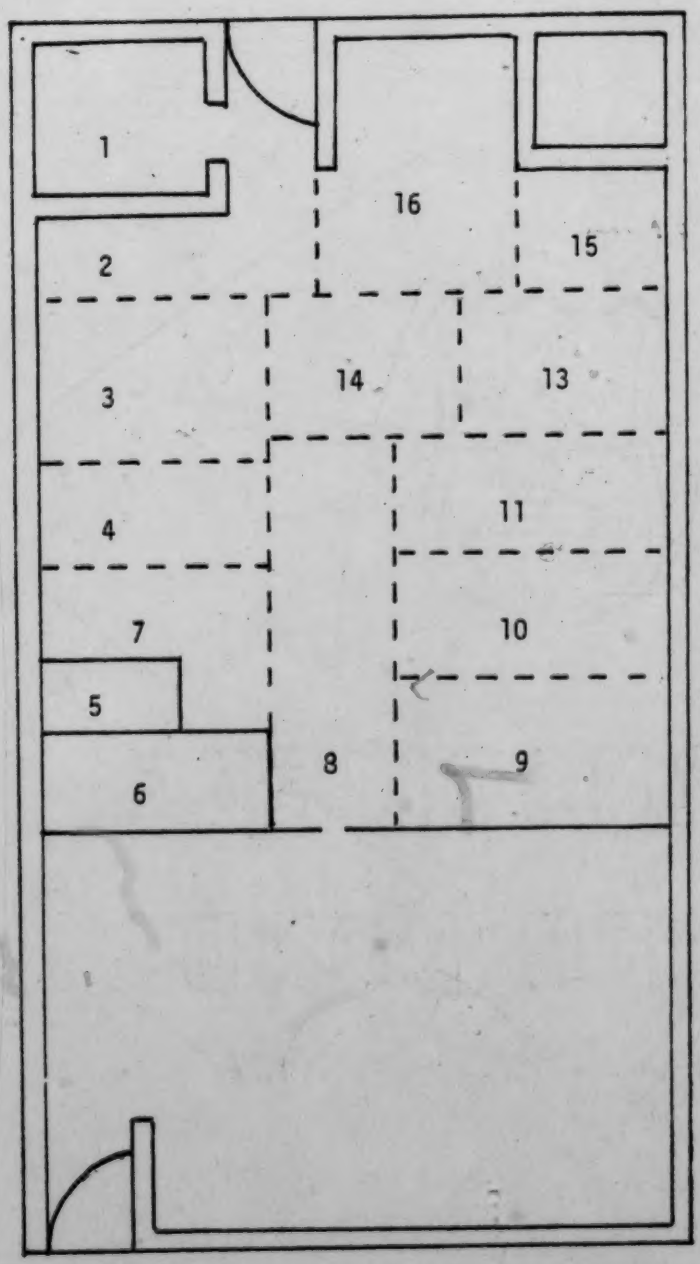
It was not possible to achieve this objective entirely. In Room A, the area beneath the loft was empty but for two chairs and a bench in Time One and Time Three. In the compacted condition, this area became the Block area and no other setting was created to serve the purpose it had previously. Another change which was made was in the location of the Paint Easel. In Time One and Time Three, the easel was located between a Craft Table and the Table Toy Area. In the compacted condition it was placed between the Blocks Area and a different Craft Table.

In Room B, the Access/Chalkboard Area was deleted in the compacted condition, Time Two. The chalkboard was removed from the room.



1. Bathroom/ Hall
2. Water Table
3. Craft Area 'A'
4. (removed)
5. Little Loft
6. Big Loft
7. Blocks
8. House
9. Felt Board
10. Music/Book
11. Table Toys
12. Sand Table/ Storage
13. Paint Easel
14. Puzzle/Snack
15. Craft Area 'B'
16. Teacher Storage

Figure 4. Room A in compacted condition.



1. Bathroom/ Hall
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11. Table Toys
12. (removed)
13. Playdough
14. Craft Area 'B'
15. Sand Table
16. Teacher Storage

Figure 5. Room B in compacted condition.

Some large interlocking plastic blocks were also removed from the Block Area. The table in the Table Toy was replaced with a smaller one, as was the table in the Playdough setting.

Table 2 describes the amount of space available to the children in the compacted condition.

Table 2

Dimensions, Area, and Density of Day Care Rooms, Compacted Space

	Room A	Room B	Average for both rooms
Dimensions (meters	8.8 x 7.2	9.1 x 7.2	9.0 x 7.2
Area (m^2)	63.4	65.5	64.5
Area deleted (m^2)	34.5	32.4	33.5
Covered Space (m^2)	9.1	11.0	10.1
Uncovered Space (m^2)	54.3	54.5	54.4
Density with 20 children (m^2/child)	2.7	2.7	2.7

Daily Program

All three rooms in which observation occurred followed a similar daily schedule. The center opened at 7:30 a.m. and most children had arrived by 9:00 a.m. and remained for the full day. From the time of arrival until approximately 10:00 a.m. the children had a free play period where all areas of the room were open to them. Craft activities would be set out for the children to use. During the latter part of the free play period, a mid-morning snack would be brought into the room. Snack, then, became another activity which the children

could choose except that the staff exercised more managerial checking to note whether or not children had been for snack. Occasionally during the free play period groups would gather either spontaneously or, infrequently, by teacher initiation, for a story or other group activity. The rest of the program followed a regular day care routine and included outdoor play, lunch, a nap time, and more free play periods.

The observation period for this study took place during this morning free play period beginning at 8:45 a.m. by which time the majority of the children had arrived for the day, and lasted one hour until 9:45 a.m. Slight changes in room schedules were made by staff members to ensure that the free play period would occur at the same time each day and at the same time in each room in order to facilitate data collection.

C. The Children

The subjects for this study were all 59 of the children registered in three rooms of the day care center. Data were collected on all children though the data for 16 children was discarded due to inconsistency of attendance or insufficient observations. To be included in the study, a child must have been observed in at least 65% of the room scans. Attendance must have been evenly spread throughout the three density conditions. Data were used for a total of 43 children though the presence of the other children was considered when calculating the density of the rooms.

Prior to data collection the purpose of the study was explained in a letter to the parents of the children. Permission to include the children in research projects had previously been obtained from

the parents.

The age range for the children was 2.8 years to 5.9 years with a mean age of 4.5 years. Children were described as older or younger by comparing their age to that of the mean age. Any child older than 4.5 years was classified as "older" and any child younger than 4.5 years was classified as "younger". The breakdown by ages and sex of the children according to room is listed in Table 3.

Table 3

Sex and Age of Subjects By Room

	OLDER	YOUNGER	TOTAL
Males			
Room A	4	4	8
Room B	2	5	7
Room C	4	3	7
TOTAL	10	12	22
Females			
Room A	3	4	7
Room B	3	2	5
Room C	6	3	9
TOTAL	12	9	21
		TOTAL	43

D. Instrumentation

The Room Scan

The instrument used to gather data was a room scan developed by McGrew and McGrew (1972), with adaptations as described by Tyler (1975). Massing (1979) used this methodology in her study of children's use of space and found it a useful measure of children's spatial behavior.

Each supervisor was asked to arrange the room as they would like to have it remain during the data collection period. The settings in each room were delineated by the researcher in consultation with the room supervisor according to patterns of setting use. In most cases the settings were bounded by furniture such as cupboards or architectural features such as walls. If there were no obvious boundaries, masking tape was laid on the floor to mark each setting. Room scan maps were divided into sections which corresponded with the activity settings. Each setting was numbered. When the space was compacted during Time Two, settings were reorganized in the smaller space and marked with tape of a different color. Sets of room scan maps were made to correspond with the new spatial arrangement.

The maps were used by an observer who moved around the room, and scanned the room, setting by setting, in numerical order, during a two minute period. In each setting the observer noted the presence of any child or staff member, whether a child's behavior was setting specific or non-setting specific, and the category of social play in which a child was engaged. The scan was repeated 30 times during a one hour free play time period.

E. Observer Training

Four observers were used to gather the data. The observers participated in a training program prior to the beginning of data collection. Initially, the observers practised using the coding categories by viewing videotapes of children's play and categorizing the behavior. Next they practised the room scan methodology in a playschool where the number of children involved and the number of settings used were limited. Finally, the observers practised at the day care

center where the study was located with the children who would participate in the study. This final session allowed the observers to become familiar with the children and the settings. It also allowed the children to become accustomed to the presence of the observers and the observation procedures. The children were instructed by the day care staff that the observers were working and that they should not intervene in the children's activities unless it appeared that a child might be hurt or was in an unsafe position. All requests for assistance or aid were referred to a staff member. Attempts at conversation by the children were generally responded to by nods, other non-verbal responses, or by telling children that the observers had to work. In total, the observers were involved in ten hours of training.

F. Observer Agreement

Three observers each collected data primarily in one room, and the fourth observer acted as a criterion observer for establishing intergroup reliability by observing simultaneously with the observers on occasion in all three rooms.

The level of agreement to determine the reliability of the observers was calculated using the formula:

$$\frac{\text{no. seen by both A and B}}{(\text{no. seen by A + B})+(\text{no. seen by A})+(\text{no. seen by B})}$$ (McGrew, 1972).

The average level of agreement reached between the criterion observer and each of the other observers prior to the study was 89%. During the observation period, the criterion observer gathered data simultaneously with each of the other observers a total of ten days. This constituted 296 scans or 12.5% of the total scans made. The

average level of agreement reached during the simultaneous scans during the data collection period was 91.8%.

G. Data Collection

The room scan methodology was used to gather data on children's use of space in two treatment rooms and a control room. The two treatment rooms were chosen because of the similarity of the rooms in size, configuration, staff stability during the collection period, and agreement by staff to participate in the study. The control room was used previously for research by Massing (1979). It was felt that interesting comparisons could be made between Massing's results and those found in the control room.

Observations were made in the two experimental rooms, Room A and Room B, for a two week period during which no changes were made in the available space. This period, Time One, was to provide base data on normal behavior exhibited by the children in the rooms. During Time Two, the space was reduced to increase spatial density. Data collection during this condition was originally scheduled to last two weeks. As the data were being collected in the two experimental rooms it became apparent that there were abnormally high levels of absenteeism, despite the fact that attendance records which had been checked prior to the beginning of the study indicated that attendance was generally stable. In order to gather sufficient data at the higher density levels, the observation period during Time Two was extended to three weeks. The spatial arrangement was returned to the original room configuration for the final data collection period. Data were gathered in Time Three for eight days.

In all data were gathered for 33 consecutive week days in the two experimental rooms. Data was also collected in the control room, where no spatial re-arrangement occurred, for 16 days on an every-other-day basis.

H. Data Analysis

The data which were collected during this study consisted of 990 scans in each of Room A and Room B, and 480 scans in Room C. Computer analysis of the room scan data produced frequency and percentage data regarding setting use, setting specific behavior, and social interaction behavior of the children. This method of analyzing the data was considered appropriate because of the small sample size, and the uneven distribution of males and females and older and younger children which would obscure the validity of a statistical analysis. Analysis based on percentages was deemed appropriate because it was not always possible to code each child on each scan. Children were only coded once on each scan and it was possible that a child might move into an area previously scanned before the room scan was completed, and no data would be available for that child. The data was organized so that comparisons could be made between rooms, between males and females, and between younger and older children for each density condition. The findings of the data analysis will be presented in Chapter IV.

It was necessary to eliminate data for some children and for specific days because of low attendance. Elimination of data on children has been outlined previously in the discussion of the children. Because of fluctuations in attendance, it was found that the density on some days during Time Two overlapped and was lower than some of the density

figures in Time One and Time Three. It was decided to define high density as that which occurred when there were less than 4.45 m^2/child of space available, and low density as that which occurred when there was more than 4.45 m^2/child of space available. Days during Time Two on which the density was less than 4.45 m^2/child were deleted. Using the revised density figures, Table 4 shows the attendance range, density range, and mean density for each condition in each of the experimental rooms, and for the total data collection period in the control room. Two days of data were eliminated in Room A, and seven days of data were eliminated in Room B.

I. Summary

The purpose of this study was to investigate the effects of variations in density on three aspects of children's behavior: their use of settings, the amount of setting specific behavior, and the types of social interactions they exhibit. Forty-three children were studied in three rooms at a non-profit public day care center. The space in two of the rooms was manipulated to increase the density. The third room was left unaltered. The instrument used to investigate the problem was a room scan which recorded children's use of space and aspects of behavior within the space. Observers were trained in the use of the instrument prior to data collection and reliability was checked during data collection. The collection period was divided into three parts. For the first ten days data was gathered in the original space, then the space was compacted in the experimental rooms. Data was gathered in the compacted space for fifteen days. The space in the experimental rooms was returned to the original configuration, and data was gathered

Table 4

Attendance and Density Figures in The Day Care Rooms
Using the Revised Sample

	Room A			Room B			Room C
	Time One	Time Two	Time Three	Time One	Time Two	Time Three	
Attendance Range	14-19	12-19	14-18	10-18	12-18	12-15	11-18
Density Range (m^2/child)	4.7-5.9	2.9-4.4	5.3-5.8	5.1-8.2	3.0-4.4	4.5-6.6	4.5-6.6
Mean Density (m^2/child)	5.3	3.5	5.5	6.2	3.8	5.3	5.3

for a further eight days in this spatial condition. Data was gathered in the control room every other day for a total of sixteen days. Data analysis involved comparisons of the percentage of behavior in each category for each density condition. Comparisons were also made on the basis of room, sex, and age.

CHAPTER IV

REPORT OF THE FINDINGS

In Chapter four, the findings of the study will be reported. The findings will be reported in three sections. The sections will discuss data which relates to 1) setting use, 2) setting specific behavior, and 3) social interaction.

The main focus of this research was to study the effects of variations in density on children's use of space, setting-specific behavior, and social interaction. The measure used to indicate the effects of differing densities was the frequency with which children were observed to be present in each setting of the child care room, the frequency with which children were observed to be participating in setting or non-setting specific activities, and the frequency in which they engaged in specified categories of social interaction. A percentage figure for each child in each category was calculated by comparing the frequency of observations made in each behavior category to the total number of observations made on that child. Mean percentages were calculated for each of the three density conditions in Room A and Room B. Time 1 refers to the period when the regular room space was available during the first two weeks of data collection. Time 2 refers to the period when the spatial area was reduced during the next three weeks of data collection. Time 3 refers to the period when the spatial area was returned to normal during the final two weeks of data collection.

The data collection period in Room C was arbitrarily divided

into three periods which corresponded with the time periods in the two experimental rooms. Mean percentages were calculated for each behavior category by time period.

Data analysis focused on two comparisons made between the three time periods - Time 1 scores contrasted with those in Time 2; and Time 2 scores contrasted with those in Time 3. Variations which involved a change from Time 1 to Time 2 and which were reversed from Time 2 to Time 3 were considered noteworthy as a possible indicator of density effects in the experimental rooms.

A. Setting Use

Using the control room as an indicator of normal behavior variations, the results from the two experimental rooms were analyzed to discover behavior patterns which differed from those in the control room and may have resulted from variations in density. Findings related to variations in setting use as well as actual amounts of setting use will be presented by room, by sex, and by age. In each case, a discussion of the findings in the control room, Room C, will precede the presentation of the findings in the experimental rooms, Room A and Room B, in order that a picture of what might be normal variations can be used as a basis of comparison for the results from the other group.

The mean percentages of setting use exhibited by five groupings of children, all children, males, females, older, and younger, were used to make comparisons between Time 1 and Time 2 and between Time 2 and Time 3 to determine the range of variations in percentage of setting use which occurred in the three study rooms. Variations were classified as less than 2.5%, between 2.5% and 5%, between 5% and 10%, and greater

than 10%. Table 5 shows the number and percentage of comparisons which occurred in each category in each room.

Table 5

Amount and Percentage of Setting Use Variations in Each Room

Room Differences	Room A Number	%	Room B Number	%	Room C Number	%
0-2.5%	115	77	98	65	84	60
2.5-5.0%	20	13	30	20	36	26
5.0-10.0%	13	9	19	13	18	13
More than 10%	2	1	3	2	2	1
Total	150	100	150	100	140	100

In Room C, 86% of the comparisons involved differences of less than 5%. From this data it was decided to use 5% and 10% as criterion figures when discussing differences of note as only a small percentage of the comparisons exceeded these figures. In Room C, 13% of the comparisons involved differences between 5% and 10%, and only 1% of the comparisons involved differences greater than 10%.

In Room A, a slightly different pattern of behavior variation occurred when 9% of the comparisons involved differences between 5% and 10% and 1% involved differences greater than 10%. The variations in behavior in Room A were slightly more stable than those in the control room despite the changes in room space and density which occurred.

The pattern of behavior variation in setting use in Room B followed that of the control room more closely with 13% of comparisons in-

volving differences between 5% and 10% and 2% of the comparisons involving differences greater than 10%.

When the amount of variations in setting use for all comparisons in the control room is compared with that in the experimental rooms, there does not appear to be any differences which could be attributed to density or space changes. The amount of variations which occur in Room A and Room B are similar to those in Room C, though variations in setting use in Room A seem slightly more stable than those in Room B and Room C.

Setting Use By Room

Mean percentages of setting use for the total group by time period for each room is shown in Table 6. Discussion of setting use will be according to room, with the control room first, followed by the experimental rooms.

Room C The data for Room C indicates that the behavior patterns of children in terms of setting use varied considerably over the data collection period. Variations between 5% and 10% were found in the House Area, the Block Area, and the Table Toy Area. An increase of 7.2% occurred between Time 1 and Time 2, and a decrease of 5.7% occurred between Time 2 and Time 3 in the Table Toy Area. An increase of 7% occurred in the House Area, and an increase of 5.4% occurred in the Block Area between Time 2 and Time 3. Patterns of setting use which reverse themselves did occur in the control room where no experimental variations were experienced.

The areas which received the greatest amount of use as indicated by the mean percentages were the Block Area (23.3%), Snack/Craft Area A

Table 6

Mean Percentage of Setting Use by Room for Three Time Periods

		Bathroom	Sink	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Block Area	Small Block Area	Scrap Table	Natural Materials Area	Snack/ Craft Area C
Room C (N=16)															
Time	1	0.7	1.6	4.7	5.0	3.4	3.2	5.0	23.6	4.6	9.1	4.2	11.5	2.4	16.6
	2	0.5	1.0	4.5	6.5	0.9	0.9	2.1	20.5	11.8	7.6	7.5	7.4	6.5	15.0
	3	0.4	1.9	5.6	4.3	2.1	1.9	9.1	25.9	6.1	8.0	4.8	9.5	4.1	13.5
Mean		0.5	1.5	4.9	5.3	2.1	3.0	5.4	23.3	7.5	8.2	5.5	9.5	4.3	15.0

		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Under Loft Area	Felt Board	Sand Table	Easel	Snack/ Puzzle Area	Teacher Storage
Room A (N=15)																	
Time	1	1.9	2.3	14.0	10.6	7.9	2.1	5.9	8.8	14.1	11.8	6.9	1.0	1.1	0.7	11.0	0.4
	2	1.5	2.3	10.9	9.3	8.6	2.1	7.6	11.9	16.1	11.1		0.4	0.5	0.4	12.3	0.8
	3	2.1	2.5	7.1	7.6	6.5	1.3	6.9	19.3	8.1	12.5	5.7	0.7	0.8	0.8	10.8	0.4
Mean		1.8	2.4	10.7	9.2	7.7	1.8	6.8	13.3	12.8	11.8		0.7	0.8	0.6	11.4	0.5

		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Fisher-Price Toys	Access Chalk-board	Sand Table	Play-dough	Access Area	Teacher Storage
Room B (N=12)																	
Time	1	1.6	4.7	15.2	12.1	4.8	1.9	3.3	18.1	6.3	4.9	4.0	0.6	10.9	4.4	3.1	0.3
	2	2.8	3.0	13.4	15.2	5.7	4.5	5.4	8.5	7.3	8.8	3.9		10.1	4.1	4.2	0.2
	3	1.7	4.5	13.5	11.8	4.6	3.0	5.5	14.8	4.3	5.1	6.0	2.4	6.9	6.5	4.6	0.4
Mean		2.0	4.1	14.0	13.0	5.0	3.1	4.7	13.8	6.0	6.3	4.6		9.3	5.0	4.0	0.4

* Due to Truncations the percentages do not total 100.

(15.0%), the Scrap Table (9.5%) and the Music/Book Area (8.2%). This pattern remained stable throughout the three time periods except in Time 2 when the Table Toy Area replaced the Scrap Table as a highly used area.

Room A The mean percentage of setting use for the total group in Room A is shown in Table 6. No score is available for the Under Loft Area in Time 2, as that setting was eliminated when the spatial change occurred. Fewer variations between 5% and 10% occurred in this room than in the control room. In the Block Area there was an increase in use of 7.4% between Time 2 and Time 3, and in the Table Toy Area, there was a decrease in use of 8.0% between Time 2 and Time 3.

The most popular areas as indicated by high levels of setting use varied according to time period. In Time 1, the most popular settings were the Table Toy Area (14.1%), Craft Area A (14.0%), the Music/Book Area (11.8%) and the Snack/Puzzle Area (11.0%). In Time 2, the most popular settings were the Table Toy Area (16.1%), the Snack/Puzzle Area (12.3%), the Block Area (11.9%), and Craft Area A (10.9%). In Time 3, the most popular settings were the Block Area (19.3%), the Music/Book Area (12.5%), the Snack/Puzzle Area (10.8%) and the Table Toy Area (8.1%). The popularity of the Block Area increased steadily over the data collection period, and especially in Time 3.

Room B The mean percentage of setting use in each time period in Room B is shown on Table 6. No score is available for the Access/Chalkboard Area in Time 2 as this setting was eliminated when the spatial change occurred.

In Room B, the greatest variations in setting use occurred in

the Block Area. Use of this area decreased 9.6% between Time 1 and Time 2, and increased 6.3% between Time 2 and Time 3. This variation in behavior may be an effect of the changes in spatial area which occurred in the Block Area.

The most popular areas in Room B as indicated by the percentage of use in each area varied between time periods. In Time 1 and Time 3, the order of preference was the Block Area (18.1%; 14.8%), Craft Area A (15.2%; 13.5%), Craft Area B (12.1%; 11.8%) and the Sand Table (10.9%; 6.9%). In Time 2, the use of the Block Area declined considerably and the most popular settings were Craft Area B (15.2%), Craft Area A (13.4%), the Sand Table (10.1%) and the Music/Book Area (8.8%).

Summary of Setting Use By Room

The variations which occurred in each room for the total group are illustrated in Figure 6. Generally, patterns of setting use were similar regardless of variations in spatial area. Differences which did occur in the experimental rooms, were only slightly different from those in the control room. The most notable changes all occurred in the Block Area, with use in Room A steadily increasing, and use in Room B and Room C decreasing in Time 2, and increasing in Time 3. Patterns of setting preference were more stable in Room C, the control room, than in Room A and Room B, the experimental rooms, but stability did not appear to be related to variations in density.

Setting Use By Sex

Table 7 shows the mean percentage of setting use by time period for males and females in each room.

Room C In Room C, variations in setting use for males which were

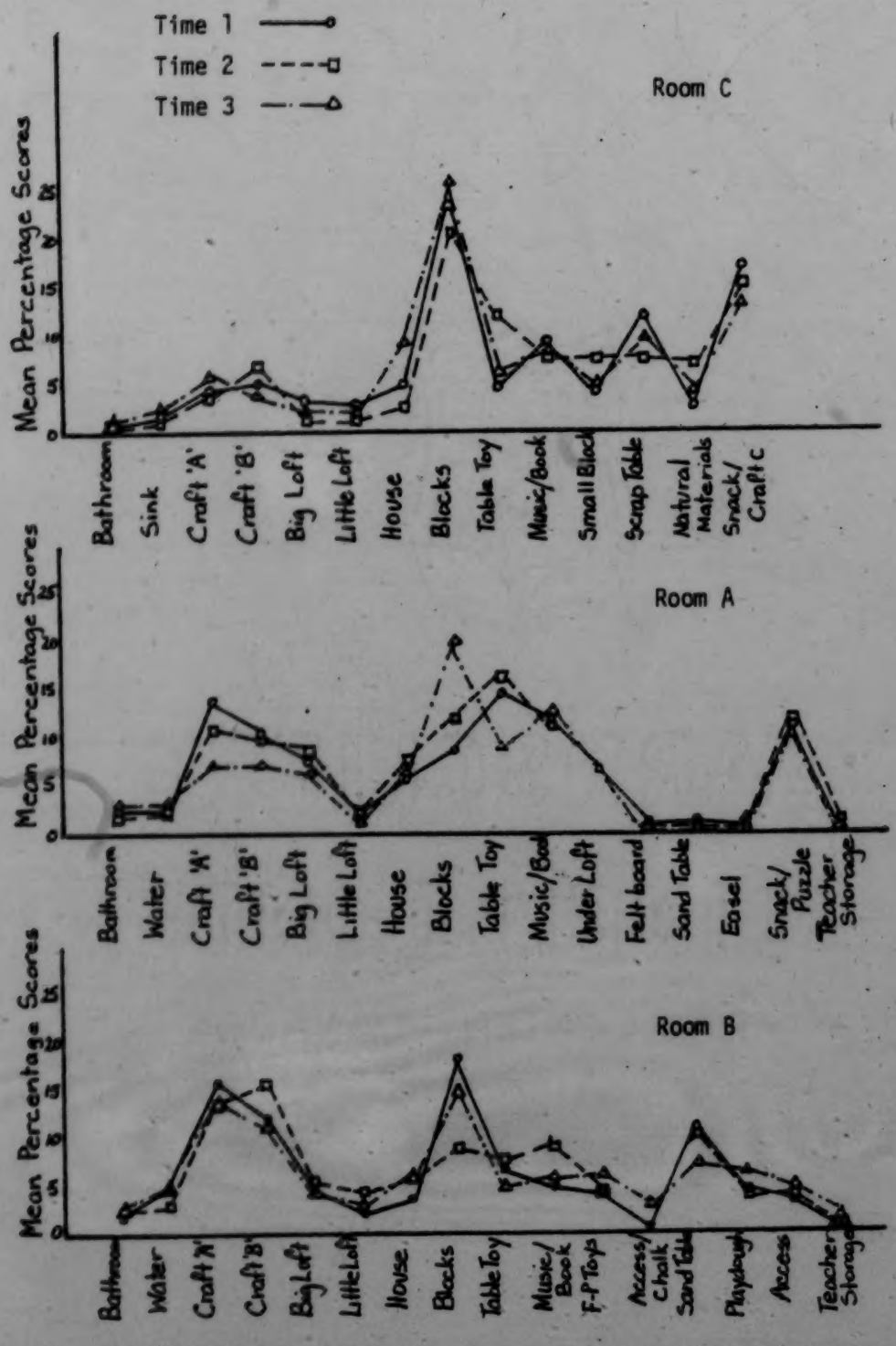

Figure 6. Mean percentage scores for setting use for the total group in Room A, Room B, Room C for three time periods.

Table 7

Mean Percentage of Setting Use by Room, by Sex for Three Time Periods

Room C		Bathroom	Sink	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table/ Toy Area	Music/ Book Area	Small Block Area	Scrap Table	Natural Materials Area	Snack/ Craft Area C
Males (N=7)															
Time	1	0.1	1.3	5.9	7.9	0.2	1.0	3.0	31.8	2.3	7.3	5.3	8.8	4.2	15.1
	2	0.5	0.6	4.5	4.3	0.9	1.3	1.5	24.6	12.3	10.3	11.7	6.9	6.1	10.4
	3	0.2	1.5	4.1	2.3	3.5	1.9	3.8	39.3	5.6	1.3	8.6	8.6	2.6	14.6
Mean		0.3	1.1	4.8	4.8	1.5	1.4	2.8	31.9	6.7	6.3	8.5	9.7	4.3	13.4
Females (N=9)															
Time	1	1.3	1.9	4.1	3.0	6.1	5.1	6.5	16.0	6.3	10.9	3.2	13.5	0.9	18.1
	2	0.6	1.6	4.5	8.5	1.2	5.9	2.6	17.2	9.8	5.8	4.3	7.9	6.6	18.5
	3	1.3	2.6	7.0	6.0	1.1	2.7	5.0	15.7	6.8	13.5	2.7	11.0	6.1	12.5
Mean		1.1	2.0	5.2	5.8	2.8	4.6	4.7	16.3	7.6	10.1	3.4	10.8	4.5	16.4

Room A		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Under Loft Area	Felt Board	Sand Table	Easel	Snack/ Puzzle Area	Teacher Storage
Males (N=8)																	
Time	1	2.2	1.5	10.6	8.1	9.0	1.1	2.0	11.8	22.1	10.5	3.5	0.5	1.0	0.6	10.5	0.3
	2	1.2	2.2	11.8	8.1	10.6	1.6	3.5	13.7	19.7	9.7		0.7	0.3	0.3	13.2	1.0
	3	2.3	1.2	4.8	6.7	9.6	1.2	2.1	24.0	12.0	14.2	4.2	0.8	1.0	0.3	10.0	0.3
Mean		1.9	1.6	9.1	8.3	9.7	1.3	2.5	16.5	17.9	11.5		0.7	0.8	0.4	11.2	0.5
Females (N=7)																	
Time	1	1.5	2.1	17.9	14.1	6.6	3.2	10.5	5.3	4.9	13.3	2.3	0.8	1.3	0.9	10.3	0.5
	2	2.3	1.6	9.9	10.9	5.1	2.9	9.6	10.0	11.9	12.7		0.4	0.7	0.6	12.7	0.7
	3	2.2	2.5	11.1	7.8	2.9	1.3	12.2	18.1	5.1	11.9	7.5	0.6	1.1	1.3	11.8	0.5
Mean		2.0	2.1	13.0	10.9	4.9	2.5	10.8	11.1	7.3	12.6		0.6	1.0	0.9	11.6	0.6

Table 7: (continued)

Room B		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Fisher-Price Toys	Access Chalk Board	Sand Table	Play-dough	Access Area	Teacher Storage
Females (N=7)																	
Time	1	1.5	4.2	12.9	9.8	5.5	2.5	1.6	26.1	7.1	1.9	2.8	0.6	14.2	2.3	3.2	0.2
	2	1.3	4.5	12.2	9.1	6.9	5.5	5.5	10.6	4.3	8.5	4.2		14.9	5.9	4.9	0.2
	3	1.2	5.8	11.5	6.8	6.2	4.2	2.1	21.2	2.6	1.8	9.1	2.9	9.6	2.6	6.3	0.5
Mean		1.3	4.8	12.2	8.6	6.2	4.1	3.1	19.3	4.7	4.1	5.4		12.9	3.6	4.8	0.3
Females (N=5)																	
Time	1	1.8	5.4	18.4	15.4	3.8	1.0	5.6	7.0	5.2	8.6	5.8	0.6	6.6	7.2	2.8	0.4
	2	4.8	0.8	15.0	23.8	4.0	3.2	5.2	8.6	11.4	9.2	3.4		3.4	4.4	3.2	0.2
	3	2.4	2.6	15.2	18.8	2.4	1.2	10.4	3.8	6.4	9.8	2.0	1.6	3.0	12.0	2.2	0.2
Mean		3.0	2.9	16.2	19.3	3.4	1.8	7.1	6.5	7.7	9.2	3.7		4.3	7.9	2.7	0.3

between 5% and 10% occurred in the Block Area, the Table Toy Area, the Small Blocks Area, and the Music/Book Area. Two variations which exceeded 10% occurred in the Block Area and the Table Toy Area. In the Block Area there was a decrease of 7.2% between Time 1 and Time 2, and an increase of 14.7% between Time 2 and Time 3. In the Table Toy Area there was an increase of 10% between Time 1 and Time 2, and a decrease of 6.7% between Time 2 and Time 3. In the Small Blocks Area, there was an increase of 6.4% between Time 1 and Time 2 and a decrease in the Music/Book Area of 9.0%.

Setting preferences for males as indicated by mean setting use scores indicated that the Block Area (31.9%) was the most popular setting followed by the Snack/Craft Area C (13.4%), the Scrap Table (9.7%) and the Small Blocks (8.5%). This pattern was not consistent throughout all time periods but varied during the data collection period.

Females in Room C showed the greatest variation in setting use in Craft Area B, the Music/Book Area, the Scrap Table Area, and Snack/Craft Area C. Between Time 1 and Time 2, use of Craft Area B increased 5.5%, and use of the Scrap Table increased 5.7%. Use of the Music/Book Area increased 5.1% between Time 1 and Time 2, and decreased 7.4% between Time 2 and Time 3. Use of the Snack/Craft Table C decreased 9.0% between Time 2 and Time 3.

The most popular settings for females as indicated by mean setting use over the entire data collection period were Snack/Craft Area C (16.4%), Block Area (16.3%), the Scrap Table (10.8%) and the Music/Book Area (10.1%). These settings were consistently the most popular for females in each time period though not necessarily in the

same order or preference. In Time 2, the Craft Area B was used more than the Music/Book Area.

Comparisons between males and females in Room C show that they exhibit the same amount of variations of setting use though some of the variations shown by males were larger. Variations occurred most frequently in the areas in which the greatest setting use occurred. Males and females show similar setting preferences for the Block Area, Scrap Area, and Snack/Craft Area C, though males spent more time in the Small Block Area, and females spent more time in the Music/Book Area.

Room A Mean percentages of setting use for Room A for each time period for males and females are found in Table 7. Variations in setting use between 5% and 10% exhibited by males in Room A occurred in Craft Area A, and the Table Toy Area, and greater than 10% occurred in the Block Area. Between Time 2 and Time 3, there was a decrease of 7% in use for Craft Area A, a decrease of 7.7% for the Table Toy Area, and an increase in the use of the Block Area of 10.3%.

Setting preference as indicated by percentage of setting use was fairly consistent across time periods and density conditions although the order of preference changed. In Time 1 the most frequently used settings were the Table Toy Area (22.1%), the Block Area (11.8%), Craft Area A (10.6%), and the Snack/Puzzle Area (10.5%). In Time 2 the most popular settings were the Table Toy Area (19.7%), the Block Area, (13.7%), the Snack/Puzzle Area (13.2%), and Craft Area A (11.8%). The greatest changes occurred in Time 3 when the most popular settings were the Block Area (24.0%), the Music/Book Area (14.2%), the Table Toy Area (12.0%) and the Snack/Puzzle Area (10.0%).

Females in Room A showed variations in setting use greater than 5% in the same areas as males, in Craft Area A, the Table Toy Area, and the Block Area, but the variations did not consistently follow the same trend. Between Time 1 and Time 2, use of Craft Area A decreased 8%, and use of the Table Toy Area increased 7%. Between Time 2 and Time 3, use of the Table Toy Area decreased 6.8%, and use of the Block Area increased 8.2%.

Setting preferences for females changed during the three time periods. The most popular settings in Time 1 were Craft Area A (17.9%), Craft Area B (14.1%), the Music/Book Area (13.3%), and the House Area (10.5%). In Time 2, the most popular settings were the Snack/Puzzle Area (12.7%), the Music/Book Area (12.7%), the Table Toy Area (11.9%), and Craft Area B (10.9%). In Time 3, the most popular settings were the Block Area (18.1%), the House Area (12.2%), the Music/Book Area (11.9%), and the Snack/Puzzle Table (11.8%).

Males and females exhibited a similar amount of variation in setting use. The patterns of behavior were fairly stable for both with only a few areas showing notable differences. Both males and females increased their use of the Block Area in Time 3, though the increase was greater for males than for females. Most of the changes in setting use for males occurred in Time 3, while females exhibited changes throughout the data collection period. Females increased their use of the Table Toy Area in the higher density condition and decreased it when the space returned to normal. This variation may be an effect of the change in density.

Room B Table 7 shows the mean percentage of setting use for males and

females in each time period in Room B. Variations in the use of settings by males included three variations between 5% and 10% and two greater than 10%. In the Block Area, use decreased 15.5% between Time 1 and Time 2, and increased 10.7% between Time 2 and Time 3. Because of the reverse nature of the variation, changes in density may have affected this pattern of setting use. Another setting use pattern which may be related to changes in space occurred in the Music/Book Area. An increase of 6.6% occurred between Time 1 and Time 2, and a decrease of 6.7% occurred between Time 2 and Time 3. The other notable variation in setting use by males was a decrease in the use of the Sand Table of 5.3% from Time 2 to Time 3.

The most popular settings for males were consistent across all three time periods though the order of preference varied. In Time 1 the settings which received the highest use were the Block Area (26.1%), the Sand Table (14.2%), Craft Area A/Snack (12.9%), and Craft Area B (9.8%). In Time 2, the popularity of the Block Area slipped, and the most popular areas were the Sand Table (14.9%), Craft Area A (12.2%), the Block Area (10.6%), and Craft Area B (9.1%). In Time 3, the Block Area regained its popularity and highest use settings were the Block Area (21.2%), Craft Area A (11.5%), the Sand Table (9.6%),and Craft Area B (6.8%).

Females in Room B showed variations of setting use between 5% and 10% in the Table Toy Area, the House Area, the Playdough Area, and Craft Area B. Between Time 1 and Time 2 use of Craft Area B increased 8.4%, and then decreased 5% between Time 2 and Time 3. Use of the Table Toy Area increased 6.2% between Time 1 and Time 2. Between Time 2 and Time 3, use of the Playdough Table increased 7.6%, and use of

the House Area increased 5.2%. The reverse nature of the variations which occurred in Craft Area B may be a result of the change in density or spatial area.

Females spent a considerable amount of time in the Craft Area but preferences of other areas varied across time periods. In Time 1, the preferred settings were Craft Area (18.4%), Craft Area B (15.4%), the Music/Book Area (8.6%) and the Block Area (7.0%). In Time 2, preferred settings were Craft Area B (23.8%), Craft Area A (15.0%), the Table Toy Area (11.4%), and the Music/Book Area (9.2%). In Time 3, the preferred settings were Craft Area A (18.8%), Craft Area B (15.2%), the Playdough Table (12.0%), and the House Area (10.4%).

The amounts of variation in setting use exhibited by males included two large variations greater than 10% in the Block Area. Females exhibited the same number of variations but in smaller amounts. The effect of the spatial change in Time 2 may have been responsible for the extreme variation in the use of the Block Area by males. The other patterns of setting use which may have been related to spatial change was the use of the Music/Book Area by males and the use of Craft Area B by females.

Males used the Block Area and Sand Table three times as often as females, and females used Craft Area B, the Playdough Table, and the Music/Book Area more often than males. Other areas received similar amounts of use by males and females.

Summary of Setting Use By Sex

Variations in density as a result of spatial changes appear to have only a minimal effect on patterns of setting usage for males

and females. Variations which occurred in the control room are similar to those which occurred in the experimental rooms. Variations which show a trend between Time 1 and Time 2, which is reversed between Time 2 and Time 3 may be indicative of density effects, but conclusions can only be tentative as the same pattern of variations occurs in the control room. The largest variations in all rooms for males occurred in the Block Area. There was no consistent pattern for females across rooms.

Patterns of setting preference vary between rooms for males and females, though some preferences seem to be consistent regardless of room. Males consistently show a preference for the Block Area, while females consistently show a preference for the Craft Areas. There is overlap between settings used by males and females, though generally males seem to prefer construction areas (Blocks, Table Toys, Small Blocks) while females seem to prefer Craft Tables with some use of the Block Area and the Table Toy Area.

Setting Use by Age

Room C Table 8 illustrates patterns of setting use by age. Older children showed variations in setting use in the Table Toy Area, the Block Area, and the Small Blocks Area. Between Time 1 and Time 2, use of the Table Toy Area increased 9.4%, and use of the Small Blocks Area increased 5.9%. Between Time 2 and Time 3, use of the Small Blocks Area decreased 6.6%, and use of the Block Area increased 7.2%. An analysis of the increase in the Block Area suggests that the increase was mostly the result of males, and not all older children. Use of the House Area increased by 8.7% between Time 2 and Time 3.

Preference of setting as exhibited across all periods show

Table 8

Mean Percentages of Setting Use by Room, by Age for Three Time Periods

Room C		Bathroom	Sink	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Small Block Area	Scrap Table	Natural Materials Area	Snack/ Craft Area C
Older (N=10)															
Time	1	0.4	2.0	4.5	5.1	3.8	3.4	4.6	18.1	3.3	11.3	5.4	15.7	2.0	18.3
	2	0.6	0.9	3.5	5.3	0.6	3.2	1.2	14.6	12.7	9.1	11.3	11.0	5.0	15.5
	3	0.3	1.3	2.5	4.1	0.5	2.1	9.9	21.8	8.8	9.8	4.6	12.3	2.8	13.9
Mean		0.4	1.4	3.5	4.8	1.6	2.9	5.2	18.2	8.3	10.1	7.1	13.0	3.3	15.9
Younger (N=6)															
Time	1	1.5	1.9	5.5	5.2	2.9	3.4	5.9	32.4	6.7	6.0	2.2	4.4	4.2	14.2
	2	0.5	1.5	6.2	8.7	1.8	4.9	3.5	30.2	8.0	5.5	1.4	1.7	7.2	14.4
	3	0.5	2.9	10.9	4.7	1.2	1.5	7.9	32.7	1.5	4.9	4.7	4.9	6.4	12.7
Mean		0.8	2.1	7.5	6.2	2.0	3.3	5.8	31.8	5.4	5.5	2.8	3.7	5.9	13.8

Room A		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Under Loft Area	Felt Board	Sand Table	Easel	Snack/ Puzzle Area	Teacher Storage
Older (N=7)																	
Time	1	1.1	1.2	11.3	9.6	10.5	2.6	5.9	9.7	16.9	12.2	2.7	0.6	1.6	0.5	8.5	0.3
	2	0.2	1.9	10.1	8.2	10.5	0.9	9.1	11.7	16.9	12.8		0.2	0.3	0.1	12.3	1.2
	3	1.5	1.2	6.2	8.5	5.6	1.1	7.3	21.3	8.9	14.9	7.1	0.2	0.8	0.9	9.9	0.2
Mean		1.0	1.4	9.2	8.8	8.9	1.5	7.4	14.2	14.2	13.3		0.3	0.9	0.5	10.2	0.6
Younger (N=8)																	
Time	1	2.6	2.2	16.2	12.0	5.6	1.6	5.8	8.2	11.6	11.5	3.0	1.3	0.7	0.9	12.1	0.5
	2	2.5	1.3	11.7	10.3	8.2	4.5	6.3	12.3	15.5	9.6		0.6	0.6	0.5	13.5	0.5
	3	2.7	2.3	7.8	8.1	7.2	1.5	6.3	20.3	8.6	11.6	4.6	1.1	0.9	0.7	11.5	0.6
Mean		2.6	1.9	11.9	10.1	7.0	2.5	6.1	13.6	11.9	10.9		1.0	0.7	0.7	12.4	0.5

(continued)

Table 8: (continued)

Room B		Bathroom	Water Table	Craft Area A	Craft Area B	Big Loft	Little Loft	House Area	Block Area	Table Toy Area	Music/ Book Area	Fisher-Price Toys	Access Area/ Chalk-board	Sand Table	Play-dough Table	Access Area	Teacher Storage
Older (N=5)																	
Time	1	1.4	3.6	17.8	17.6	5.6	0.8	3.8	14.4	7.4	7.6	5.0	0.4	3.2	3.6	3.2	0.3
	2	3.2	1.6	13.4	20.8	9.6	3.6	6.2	6.2	9.0	8.6	3.8		6.8	2.6	3.6	0.2
	3	1.6	2.2	13.6	16.0	3.6	2.8	6.2	11.6	3.8	8.0	6.0	1.4	2.8	9.0	5.2	1.4
Mean		2.1	2.5	14.9	18.1	6.3	2.7	5.4	10.7	6.7	8.1	4.9		4.3	5.1	4.0	0.6
Younger (N=7)																	
Time	1	1.8	5.5	13.2	8.2	4.2	2.6	2.9	20.8	5.5	2.6	3.3	0.8	16.6	4.9	3.1	0.2
	2	1.1	3.9	13.2	11.2	5.6	5.2	4.8	8.9	6.1	8.9	3.1		12.5	6.6	4.6	0.2
	3	1.8	6.1	12.6	8.8	5.3	3.1	5.1	16.1	4.6	3.1	6.1	3.1	9.8	4.8	4.2	0.2
Mean		1.6	5.2	13.0	9.4	4.9	3.9	4.3	15.3	5.8	5.9	4.2		13.0	5.4	4.0	0.2

older children using the Block Area (18.2%), Snack/Craft Area C (15.9%), the Scrap Table (13.0%) and the Music/Book Area (10.1%) most frequently. This is a generally consistent pattern over the three time periods, though the order of preference varies and in Time 2 the Small Blocks Area was more popular than the Music/Book Area.

For younger children, there was only one variation on setting use greater than 5%. Use of the Table Toy Area decreased 6.5% between Time 1 and Time 2.

Areas which received the greatest use by younger children were the Block Area (31.8%), Snack/Craft Area C (13.8%), Craft Area A (7.5%) and Craft Area B (6.2%). This pattern of use for the Block Area and Snack/Craft Area C remained constant during the data collection period, but other areas of high use in Time 1 were the Table Toy Area and the Music/Book Area, in Time 2 were the Table Toy Area and Craft Area B, and in Time 3 were the House Area and Craft Area.

Patterns of setting use in Room C were more stable for younger children than for older children as indicated by variations in setting use. Preference of the Block Area and Snack/Craft Area C is similar for older and younger children though younger children spend considerably more time in the Block Area than older children. Older children spent more time in the Table Toy and Music/Book Areas while younger children spent more time in Craft Area A and Craft Area B.

Room A Table 8 shows the mean percentage of setting use for older and younger children in Room A during each time period. In Room A variations in behavior for older children occurred in the Block Area and the Table Toy Area. Between Time 2 and Time 3, use of the Block Area increased

10.8% and use of the Table Toy Area declined 8.0%.

Setting preferences of older children during Time 1 were the Table Toy Area (16.9%), the Music/Book Area (12.2%), Craft Area A (11.3%) and the Big Loft (10.5%). In Time 2, the most popular settings were the Table Toy Area (16.9%), the Music/Book Area (12.8%), the Snack/Puzzle Area (12.3%), and the Block Area (11.7%). In Time 3, the Block Area increased in popularity and the most popular settings were the Block Area (21.3%), the Music/Book Area (14.9%), the Snack/Puzzle Area (9.9%) and the Table Toy Area (8.9%).

The same pattern of variations occurred for younger children as for older children. Between Time 2 and Time 3, use of the Block Area increased 8.0%, and use of the Table Toy Area declined 6.9%.

Patterns of setting preferences for younger children differ from those of older children, and vary over time. In Time 1, the most preferred areas were Craft Area A (16.2%), Snack/Puzzle Area (12.1%), Craft Area B (12.9%) and the Table Toy Area (11.6%). In Time 2, the pattern changed so that the most popular areas were the Table Toy Area (15.5%), the Snack/Puzzle Area (13.5%), the Block Area (12.3%), and Craft Area A (11.7%). In Time 3, an increase in use of the Block Area occurred. The most popular areas were the Block Area (20.3%), the Music/Book Area (11.6%), the Snack/Puzzle Area (11.5%) and the Table Toy Area (8.0%).

Older and younger children in Room A exhibited few variations in setting use and those which occurred were similar for each group. Setting use data indicate that older and younger children use the same settings though older children used the Big Loft and the Table Toy Area more, and younger children used the Craft Areas more frequently.

Room B Setting use means for older and younger children are shown in Table 8. Setting variations for older children occurred in the Block Area, the Table Toy Area, the Big Loft, and the Playdough Area. Between Time 1 and Time 2 use of the Block Area decreased 8.2% and between Time 2 and Time 3 increased 5.4%. This finding may be related to spatial changes which occurred in the room. Other changes which occurred between Time 2 and Time 3 were a decrease of 6.0% in the use of the Big Loft, an increase of 5.2% in the use of the Table Toy Area, and an increase of 5.4% in the use of the Playdough Area.

Older children showed consistently high use of Craft Area A/Snack, and Craft Area B in all three time periods. Other setting use patterns varied by time period. In Time 1, the highest setting use was in Craft Area A/Snack (17.8%), Craft Area B (17.6%), the Block Area (14.4%), and the Music/Book Area (7.6%). In Time 2, the most popular settings were Craft Area B (20.8%), Craft Area A/Snack (13.4%), the Big Loft (9.6%) and the Table Toy Area (9.0%). In Time 3, the settings most frequented were Craft Area B (16.0%), Craft Area A (13.6%), the Block Area (12.6%), and the Playdough Area (9.0%).

Younger children exhibited variations of setting use in the Block Area, and the Music/Book Area. Between Time 1 and Time 2, use of the Block Area decreased 11.9%, and use of the Music/Book Area increased 6.3%. Between Time 2 and Time 3, use of the Block Area increased 7.2%, and use of the Music/Book Area decreased 5.8%. Both of these patterns of behavior reverse themselves, and may have been influenced by the change in spatial area.

The most popular settings for younger children were the Craft Areas, the Sand Table, and the Block Area, though the order of

preference changed over time. In Time 1, the most popular settings were the Block Area (20.3%), the Sand Table (12.5%), Craft Area A (13.2%), and Craft Area B (8.2%). In Time 2 the most popular settings were Craft Area A (13.2%), the Sand Table (12.5%), Craft Area B (11.2%), and both the Block Area and the Music/Book Area (8.9%). In Time 3, the most popular settings were the Block Area (16.1%), Craft Area A (12.6%), the Sand Table (9.8%) and Craft Area B (8.8%).

Older children in Room B exhibited more variations in setting use than younger children. Both younger and older children exhibited a similar pattern of decrease in use of the Block Area between Time 1 and Time 2, and an increase in use of the Block Area between Time 2 and Time 3. An analysis of this pattern by individual data indicates that most of the variation in this setting originates with males, and may not be related to age factors. Both groups preferred similar settings though older children were more often in Craft Area B and the Music/Book Area and younger children were more often in the Block Area and the Sand Table.

Summary of Setting Use By Age

Setting use by older and younger children appears to be affected only slightly by changes in spatial area. Fewer variations occurred in the control room for younger children than in the experimental rooms which may indicate some effect of spatial changes. Only the younger children in Room B exhibited any setting use patterns which may have been related to use of space. Use of the Block Area decreased in the higher density condition and increased in the lower density conditions. The reverse pattern occurred in the Music/Book Area.

Older children in Room B and Room C showed more variations in setting use than younger children, while there were few variations for older children in Room A.

Older and younger children show similar patterns of setting preference, though older children seemed to show higher preferences for the Craft Areas and Table Toy Areas than younger children, and younger children use the Block Areas more.

The Block Area

The largest and most distinct variations of behavior occurred in the Block Area. Figure 7 illustrates the amount of use in this setting for each grouping of children, all, males, females, younger, and older. Patterns of use for this setting appear to be influenced by room, sex and age more than by density. The variations which occur for all, males, and younger children in Room B and Room C indicate that the variation in Room B may not be caused by spatial changes but may be a normal variation pattern. All groupings in Room A exhibit the same pattern of increasing use of the Block Area. While the increase in Time 3 may not be the direct result of density changes, it may be a reaction to the previous period of compaction.

Males show higher levels of use in the Block Area, than females in all rooms, and the variations in use which occur are greatest for males. Younger children show higher levels of use than older children in Room B and Room C but in Room A use is approximately the same for both groups. Children in Room C show higher levels of Block Area use than those in Room A or Room B.

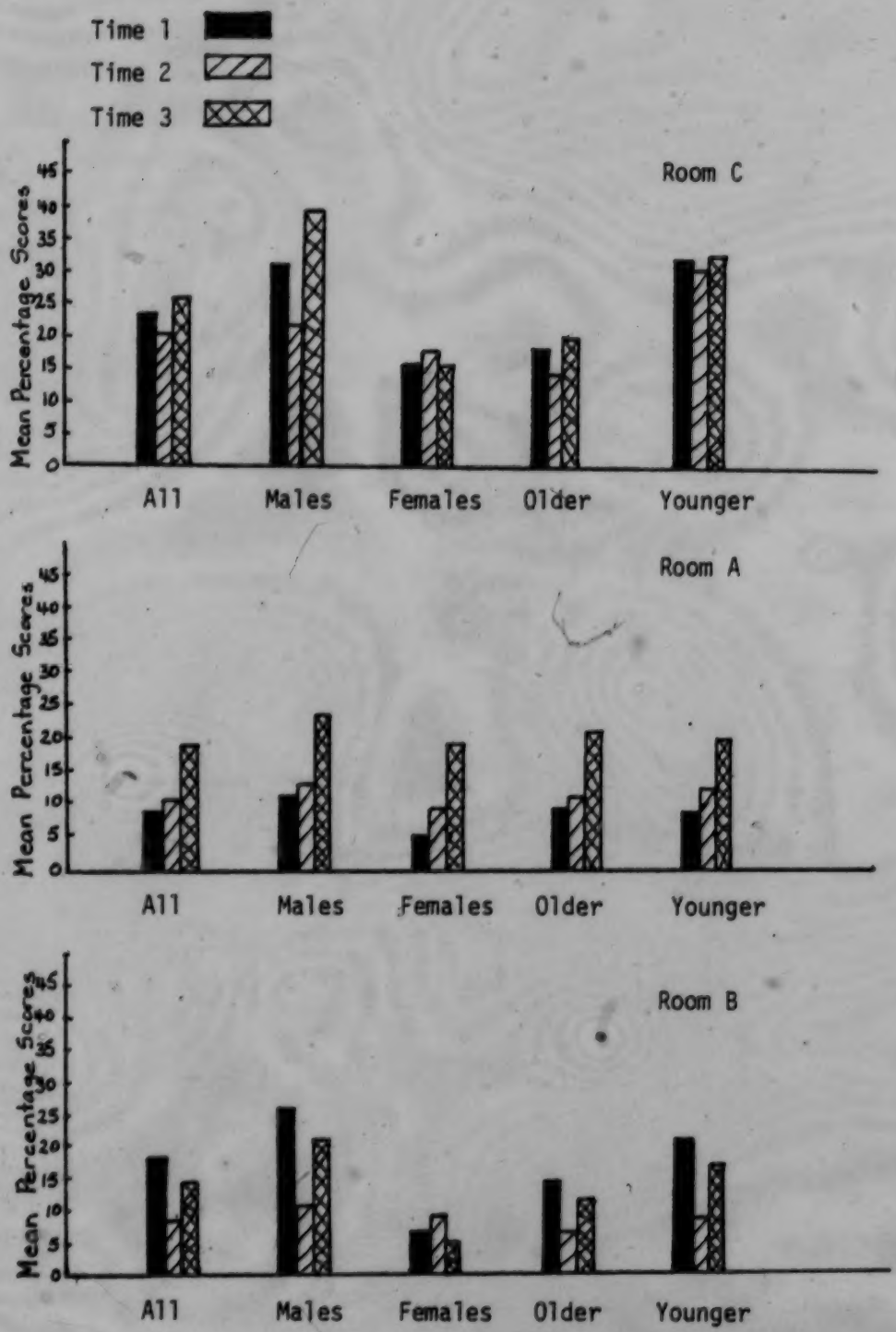

Figure 7. Mean percentage of Block Area use for all children, males, females, older and younger children in Room A, Room B, and Room C during three time periods.

Summary of Setting Use

In summary, the data on the use of settings shows a very limited impact of the change of space. Because the variations in setting use in the control room, Room C, follow similar patterns to those in the experimental rooms, it is difficult to attribute any changes in behavior to the spatial changes which occurred.

The variations which occurred in Room C differed more from those in Room A than from those in Room B. Patterns of behavior in Room A were more stable than in the other two rooms, and almost all the changes occurred from Time 2 and Time 3. In Room B and Room C the variations were more equally spread over the data collection period. Influence of room in determining patterns of setting use was greater than the density effects. The patterns which occurred in each room seemed more a product of stable influences within the room than the experimental influences which were imposed on the children.

Setting use was not consistent over time but the same five or six settings in each room were used most frequently. While there were differences in each room according to setting preferences, in all rooms the Block Area, the Table Toy Area, the Craft Areas and the Music/Book Area were used heavily.

Variations in setting use were larger for males than for females. Males used fewer areas more than females and it appeared that the greatest variations occurred in highly used areas. In general, males used the Block Area more than females, and females used the House Area more than males.

Older children varied their use of setting slightly more than younger children. In Room A and Room C, younger children showed

few setting variations. Older children in Room B and Room C changed their use of settings more than children in Room A. Younger children appear to use the Block Area more than older children while older children used the Table Toy Area and the Music/Book Area more.

B. Setting Specific Behavior

Setting specific behavior was defined as behavior appropriate to the setting as determined by the materials and equipment located in the setting and by the social expectations transmitted by the staff members and children in the room. Behavior was defined as either setting specific or non-setting specific.

The mean percentage of setting specific and non-setting specific behavior in all three rooms is shown in Table 9. Almost all of the behavior coded in the three rooms was setting specific. Non-setting specific behavior never accounted for more than 6.4% of the behavior observed. This was consistent across all three rooms, regardless of density condition, sex or age.

The greatest amount of non-setting specific behavior (6.4%) occurred for females in Room A, Time 3. When the individual data for children was examined, it was found that the behavior of two older females varied considerably from the other data in this category. In Time 3, they were both coded in non-setting specific behavior in 10% of the observations made, twice as often as the mean for all children in that time period (4.5%). The behavior of these two children would also affect the means established for older children in Time 3, which was the second highest percentage.

Some of the non-setting specific behavior could have resulted

Table 9

Mean Percentage of Setting Specific Behavior, by Sex, by Room, by Age for Three Time Periods

	Room					
	A		B		C	
Group	Setting Specific	Non-Setting Specific	Setting Specific	Non-Setting Specific	Setting Specific	Non-Setting Specific
Total						
Time 1	98.6	3.2	98.7	1.3	99.9	0.1
2	97.9	2.1	98.8	1.2	96.9	3.4
3	95.5	4.5	99.7	0.3	99.3	0.7
Mean	96.7	3.3	99.1	0.9	98.7	1.3
Males						
Time 1	97.3	2.7	98.4	1.6	100	0.0
2	97.6	2.4	98.6	1.4	97.7	2.3
3	97.0	2.9	99.6	0.4	99.7	0.3
Mean	97.3	2.7	98.9	1.1	99.1	0.9
Females						
Time 1	96.1	3.9	99.0	1.0	99.0	1.0
2	98.3	1.7	99.0	1.0	96.3	3.7
3	93.6	6.4	99.8	0.2	98.9	1.1
Mean	96.0	4.0	99.3	0.7	98.1	1.9
Older						
Time 1	96.5	3.5	98.8	1.2	99.9	0.1
2	97.5	2.5	98.4	1.6	96.0	4.0
3	94.6	5.4	99.8	0.2	99.1	0.9
Mean	96.2	3.8	99.0	1.0	98.3	1.7
Younger						
Time 1	97.1	2.9	98.6	1.4	99.8	0.2
2	98.3	1.7	99.0	1.0	98.5	1.5
3	96.4	3.6	99.5	0.5	99.5	0.5
Mean	97.3	2.7	99.0	1.0	99.3	0.7

from using setting rather than materials as a basis for determining setting specific behavior. Thus when children removed the doll buggy from the house setting to take a doll for a walk, this behavior was coded as non-setting specific behavior, even though the behavior was appropriate to the equipment. It was also behavior which was condoned by the staff. Other instances of non-setting specific behavior occurred when a child was removed to another setting as an isolation tactic. The child was not behaving according to the dictates of the setting but according to a "higher authority", the staff member. Children who were arguing or fighting and using materials in an aggressive manner were also coded as involved in non-setting specific behavior.

Other than a slight impact for Room A, setting specific behavior remained unaffected by the space change. In Room A the influence of the return to the regular space may have affected the behavior of only certain individuals and not the children as a group.

C. Social Interaction

Three categories of social interaction were coded. These were solitary, parallel, and group interactions. Two related behavior categories, watching and in transition were also coded. (See Chapter I, for definitions).

As before, the behavior exhibited by children in the control room will be considered as an example of the normal variations one could expect. Behaviorial changes in the experimental rooms have been measured against the patterns found in Room C, in order to determine the effects of variations in density.

The mean percentage of behavior in each social category ex-

hibited by five groupings of children, all children, males, females, older and younger, were used to make comparisons between Time 1 and Time 2 and between Time 2 and Time 3 to determine the range of variations which occurred in the three study rooms. As before, the variations were categorized as less than 2.5%, between 2.5% and 5%, and between 5% and 10%. Table 10 shows the number and percentage of comparisons which occurred in each category in each room.

Table 10

Amount and Percentage of Social Behavior Variations in Room A, Room B and Room C

Room	Room					
	A		B		C	
Differences	No	%	No	%	No	%
0 - 2.5%	34	68	28	56	39	78
2.5 - 5.0%	16	32	13	26	9	18
5.0 - 10.0%	0	0	9	18	2	4
Total	50	100	50	100	50	100

In Room C, 96% of the differences found were less than 5%. It was decided again to use 5% as the criterion level. No behavior variations greater than 10% were obtained.

Social Interaction by Room

The mean percentage of behavior which occurred in each social category for the total group in each time period is shown in Table 11. Figure 8 illustrates the percentage of behavior in three social categories in each room for the total group.

Table 11

Mean Percentage of Social Interaction, by Room
For Three Time Periods

Room	Solitary	Parallel	Group	Watching	Transition
Room C					
Time 1	10.3	12.7	68.8	2.7	2.8
2	9.5	11.6	70.9	3.3	2.5
3	9.4	6.7	75.8	3.1	2.8
Mean	9.7	10.3	71.8	3.0	2.7
Room A					
Time 1	8.7	16.7	66.5	4.3	1.2
2	7.5	20.9	64.5	3.5	1.1
3	10.4	17.1	65.3	3.7	1.2
Mean	8.9	18.2	65.4	3.8	1.2
Room B					
Time 1	12.4	12.5	66.5	4.2	2.0
2	13.5	15.0	64.3	2.7	2.4
3	15.6	8.4	68.2	1.2	3.8
Mean	13.8	12.0	66.3	2.9	2.7

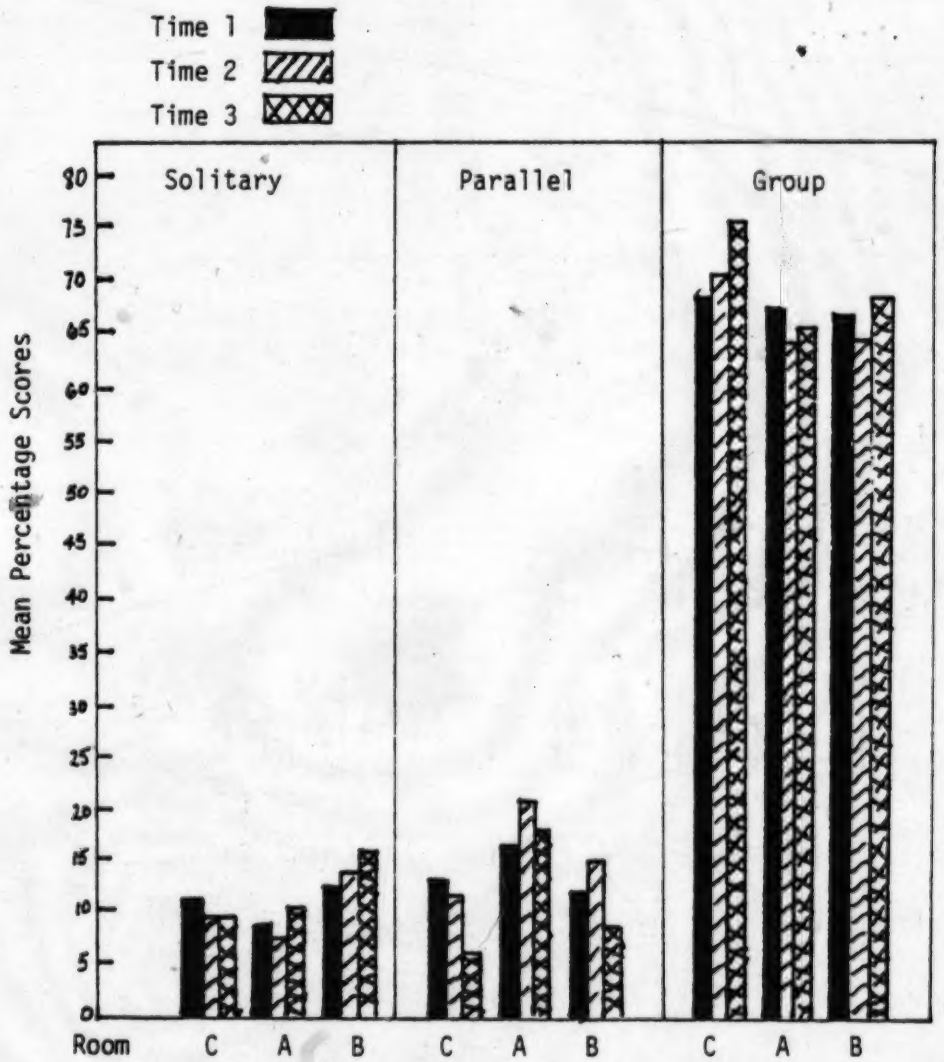

Figure 8. Mean percentage scores for social interaction for total groups in Room A, Room B, and Room C, during three time periods.

Room C In Room C, patterns of social interaction were fairly stable over the seven week data collection period. When the means for each time period for the total group were compared there were no differences greater than 5%. The majority of the behavior was coded as group (71.8%) with solitary and parallel behavior exhibited 9.7% and 10.3% of the time respectively. Watching and transitional behavior were coded rarely, and accounted for only 3.0% and 2.7% of the behavior respectively.

Room A Patterns of social interaction for the total group were very stable in Room A with no changes greater than 5% between time periods. Again, most of the behavior was categorized as group (65.3%). Parallel behavior occurred consistently more frequently than solitary. Solitary behavior occurred 8.9% of the time and parallel play accounted for 18.2% of the behavior. Watching and transitional behavior accounted for 3.8% and 1.2% of the behavior coded.

Room B In Room B, there was a decline in the percentage of parallel play of 6.6% between Time 2 and Time 3. No other variations over 5% occurred. Group play accounted for 66.4% of the social interactions while solitary play occurred 13.8% of the time and parallel play occurred 12.0% of the time. Watching and transitional behavior accounted for 3.5% and 2.7% of the social interaction respectively.

Summary of Social Interaction By Room

There were very few changes of note in the patterns of social interaction and none which could be related to changes in spatial density. Only parallel play in Room B varied more than 5%. The most

group play occurred in Room C, the most parallel play occurred on Room A, and the most solitary play occurred in Room B. Watching and transitional behavior occurred infrequently.

Social Interaction By Sex

Table 12 indicates the mean percentage of behavior which occurred in each social category by sex. Figure 9 illustrates the percentage of behavior in each category for males and females in the three rooms.

Room C Males and females exhibited similar amounts of variations in social behavior during the data collection period. Males showed an increase of 5.9% in the amount of group play coded between Time 2 and Time 3. Group play accounted for 76.5% of the behavior engaged in by males, while solitary and parallel play accounted for 6.3% and 9.6% respectively. Watching and transitional behavior were coded 1.7% and 2.5% of the time.

Females decreased their involvement in parallel play by 5.7% between Time 2 and Time 3. Group play occupied females 68.1% of the time, solitary play was coded 12.0% of the time and parallel play was coded 10.2% of the time. Watching occurred in 3.7% of the scans and transition in 2.8% of the scans.

Room A No variations in behavior greater than 5% occurred for males or females in Room A. Males were coded in group play 66.5% of the time, parallel play 17.7% of the time, solitary play 9.0% of the time, watching 3.3% of the time, and transition 1.2% of the time. Females followed a similar pattern of social interaction and group play account-

Table 12

Mean Percentage of Social Interaction by Sex, by Room for Three Time Periods

Social Behavior	Males			Females		
	Room			Room		
	A	B	C	A	B	C
Solitary						
Time 1	9.7	12.2	6.9	7.6	12.6	12.9
2	7.8	16.9	7.0	7.1	8.8	11.4
3	9.6	18.5	4.9	11.3	11.0	11.8
Mean	9.0	15.9	6.3	8.7	11.0	12.0
Parallel						
Time 1	15.5	12.5	12.9	18.0	12.6	12.5
2	21.2	17.6	8.3	20.6	11.4	11.9
3	16.3	8.1	7.6	18.1	8.8	6.2
Mean	17.7	12.7	9.6	18.9	10.9	10.2
Group						
Time 1	68.5	65.4	72.5	64.2	68.0	65.8
2	64.6	57.8	75.6	64.5	73.6	67.2
3	66.5	65.5	81.5	63.9	72.0	71.3
Mean	66.5	62.9	76.5	64.2	71.2	68.1
Watching						
Time 1	2.7	5.3	1.5	6.5	2.6	3.7
2	3.1	2.6	1.3	4.0	1.8	3.8
3	4.0	1.6	2.4	3.4	2.0	3.7
Mean	3.3	32.	1.7	4.6	2.1	3.7
Transition						
Time 1	1.1	2.3	3.3	1.2	1.4	2.4
2	1.2	3.0	1.9	1.2	1.4	2.9
3	1.2	4.1	2.3	1.2	3.4	3.1
Mean	1.2	3.1	2.5	1.2	2.1	2.8

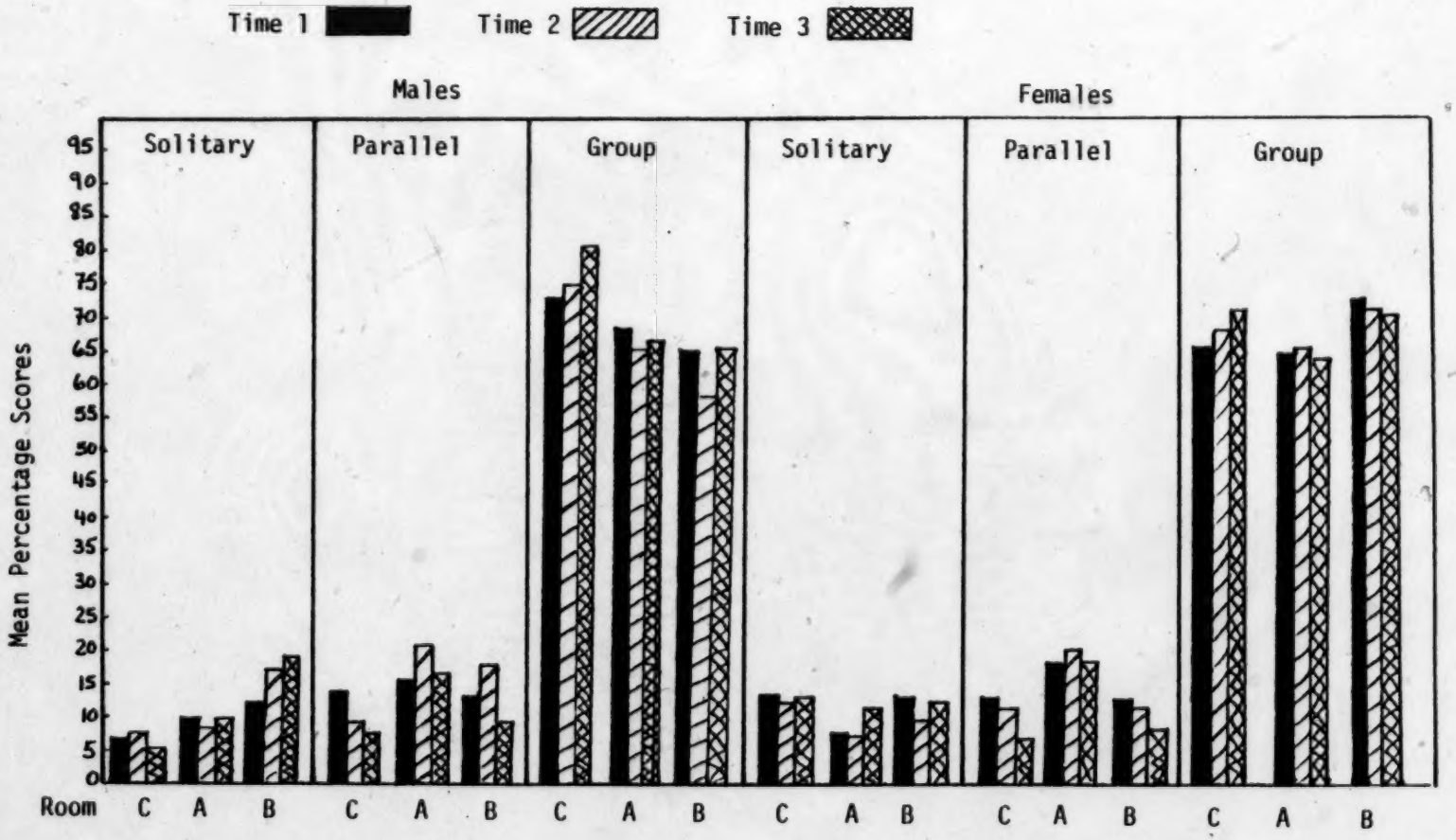

Figure 9. Mean percentage scores for social interaction for males and females in Room A, Room B, and Room C during three time periods.

ed for 64.2% of the behavior, parallel accounted for 18.9%, solitary accounted for 8.7%, watching accounted for 4.6%, and transition accounted for 1.2%.

Room B The greatest amount of variation occurred for males in Room B. Males showed an increase in parallel play of 5.1% between Time 1 and Time 2, and a decrease of 9.5% between Time 1 and Time 3. As well, males decreased their involvement in group play by 7.6% between Time 1 and Time 2, and increased it by 7.7% between Time 2 and Time 3. Males were coded in group play in 62.9% of the scans, in parallel play in 12.7% of the scans and in solitary play 15.9% of the scan. Watching and transition accounted for 2.6% and 1.4% of the behavior coded.

Females increased their involvement in group play by 5.6% between Time 1 and Time 2. Patterns of social interaction were slightly different for females with 71.2% of behavior coded as group, 10.9% coded as parallel, 11.0% coded as solitary, 2.1% coded as watching and transition.

Summary of Social Interaction By Sex

Patterns of social interaction for males and females were not consistent between rooms. For Room B, males were involved in more group play than females, in Room C, males were involved in less group play than females, and in Room A, both groups were involved in similar amounts of group play. Patterns for parallel play were similar for both groups, but patterns of solitary play again varied by room. Females were involved in more solitary play than males in Room C, and less solitary play than males in Room B.

The greatest amount of variation in social behavior occurred

for males in Room B. The pattern showed an increase in parallel play and a decrease in group play in the higher density condition. This may be related to variations in spatial density.

Social Interaction By Age

The mean percentage of behavior in each social interaction category for older and younger children in each room is shown in Table 13. Figure 10 illustrates the percentage of behavior in each category for older and younger children.

Room C Older children decreased their involvement in parallel play by 6.6%, and increased their involvement in group play by 9.1% between Time 1 and Time 2. Of the total observations made, older children were involved in group play 73.1% of the time, in parallel play 9.0% of the time and in solitary play 9.5%. Watching occurred 3.1% of the time and transition occurred 3.2% of the time.

Younger children decreased their involvement in parallel play 5.7% and increased their involvement on group play 5.4% between Time 1 and Time 2. Group play accounted for 9.5% of behavior coded, parallel play accounted for 11.6%, and solitary play accounted for 9.5% of behavior coded. Watching and transition occurred 2.8% of the time respectively.

Room A No variations greater than 5% occurred in Room A for either older or younger children. Older children spent 70.3% of their time in group interactions, 14.8% in parallel interactions, and 7.7% in solitary play. Watching occurred in 3.9% of the observations made and transition occurred in 0.9% of the observations made. Younger

Table 13

Mean Percentage of Social Interaction by Age, by Room for Three Time Periods

Social Interation	Older Room A	Older Room B	Older Room C	Younger Room A	Younger Room B	Younger Room C
Solitary						
Time 1	6.9	12.8	10.4	10.3	12.1	10.0
2	7.5	10.6	8.7	7.5	15.6	10.9
3	8.8	10.4	9.4	11.6	19.3	7.7
Mean	7.7	11.3	9.5	13.2	15.7	9.5
Parallel						
Time 1	13.2	13.4	11.4	19.7	11.9	14.9
2	17.6	11.4	11.1	23.8	17.6	9.2
3	13.6	7.6	4.5	20.2	8.9	10.7
Mean	14.8	10.8	9.0	21.2	12.8	11.6
Group						
Time 1	71.2	68.0	69.5	62.3	65.4	68.3
2	68.5	72.0	70.3	61.1	58.9	73.7
3	71.3	75.4	79.4	60.1	63.1	73.8
Mean	70.3	71.8	73.1	61.2	62.5	71.9
Watching						
Time 1	5.6	1.6	2.5	3.5	6.0	3.0
2	3.3	1.6	3.7	3.6	3.4	2.5
3	2.8	0.4	3.2	4.5	2.8	3.0
Mean	3.9	1.2	3.1	3.9	4.1	2.8
Transition						
Time 1	0.9	2.0	3.3	1.5	1.9	2.0
2	0.8	2.4	3.0	1.5	2.3	3.2
3	1.1	3.8	3.2	1.3	3.8	2.0
Mean	0.9	2.7	3.2	1.4	2.7	2.4

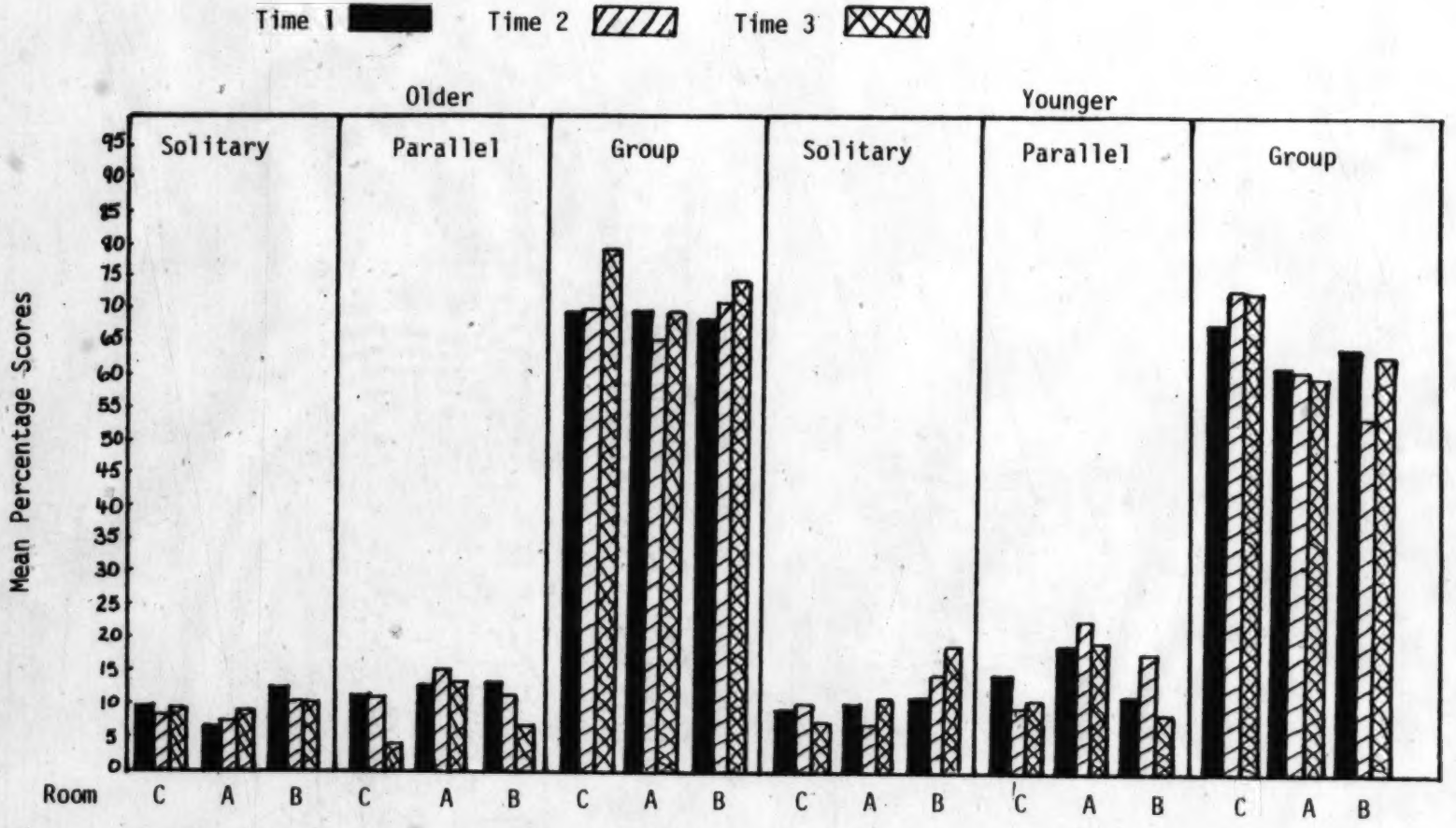

Figure 10. Mean percentage scores for social interaction for older and younger children in Room A, Room B, and Room C during three time periods.

children spent less time in group play and more time in solitary play and parallel play than older children. Group play was coded in 61.2% of the observations made, parallel play was coded in 21.2% of the observations made, and solitary play was coded in 13.2% of the observations made. Watching and transition accounted for 3.5% and 2.7% of the social interactions of younger children respectively.

Room B No variations greater than 5.0% occurred for older children. Younger children increased their involvement in solitary play 5.7% between Time 1 and Time 2, and decreased their involvement in solitary play 8.7% between Time 2 and Time 3. Younger children also decreased their involvement in group play 6.9% between Time 1 and Time 2.

Older children were involved in more group play and less solitary play than younger children. Older children were involved in group play in 71.8% of the observations, in parallel play in 10.8% of the observations and in solitary play in 11.3% of the observations. Watching and transition accounted for 1.2% and 2.7% of the observations respectively. Younger children were involved in group play in 62.5% of the observations, in parallel play in 12.8% of the observations and in solitary play in 15.7% of the observations. Watching and transition accounted for 4.8% and 2.7% of the behavior respectively.

Summary of Social Interaction By Age

The general patterns of social interaction are similar for older and younger children, with group play the most frequent social interaction. Younger children though in Room A and Room B were involved in less group play and more parallel and solitary play than older children. In Room C the patterns of social interaction were similar.

The greatest amount of variation in social behavior occurred for younger children in Room B. The pattern showed an increase in parallel play and a decrease in group play in the higher density condition. This may be related to variations in spatial density.

Summary of Social Interaction

Variations in density appear to have only limited effects on patterns of social interactions. Variations which may be the result of spatial changes include male and younger children's involvement in parallel play and male's involvement in group play in Room B. An analysis of these variations by individual children indicate that age may be a more important factor in the variations in parallel play than sex.

Patterns of social interaction varied across rooms. Children in Room C showed more group interactions than either Room A and B. Parallel play occurred most frequently in Room A, and solitary play occurred most frequently in Room B. Fewer variations were found in Room A than Room B or Room C.

Patterns of social interaction for males and females varied but the trend in the variation differed by room. Little difference was found in Room A. There was only slightly more group play for males than for females. Room B and Room C presented opposite patterns with Room B showing more group interactions for males than for females and Room C showing more group interactions for females than for males. Room B showed more solitary play for males than for females and Room C showed more solitary play for females than for males. The differences for parallel play were much smaller.

Patterns of social interaction for older and younger children were more consistent especially in the two experimental rooms. In Room A and Room B, older children were involved in more group play, less parallel play and less solitary play than older children. In Room C there were smaller differences between older and young children with the same amount of solitary play, less parallel play, and more group play for older children than for younger children. Age appears to be the most consistently influential factor in the determination of social interactions.

Analysis of Social Interaction by Individual Behavior

An analysis of the data using mean percentages of group behavior show few changes in behavior of any magnitude, the largest change being 9.9%. When the behavior of individual children is studied, it is evident that many children exhibited wide variations in behavior over the seven week period. Tables of individual children's behavior are located in Appendix B.

Room C Out of the sixteen children in Room C on whom data were collected, thirteen exhibited behaviorial changes of 10% or more in the type of social interaction in which they engaged, and three of these children exhibited behavior changes between time periods of a magnitude greater than 20%.

Room A In Room A, six out of fifteen children exhibited a change in at least one aspect of social interactive behavior of 10% or more. One child's behavior changed over 20% between two conditions.

Room B In Room B, the behavior of six out of the twelve children studied manifested behaviorial changes of at least 10% and two children's behavior changed more than 20% between two density conditions. The

patterns set were not consistent for solitary or group interaction, but all the comparisons in parallel interaction involved an increase between Time 1 and Time 2, and a decrease between Time 2 and Time 3.

Two Individual Children

When the behavior of individual children is analyzed, it becomes apparent that the majority of children fall within a range. Of the children studied, two manifested behavior patterns which were strikingly different than the others. Table 14 shows the mean percentage of time spent in each social category for each child, as well as the mean percentage of time spent in each social category by the total group for the whole data collection period. Child No. 1 in Room A and Child No. 7 in Room B were both children who began attending the child care center during the first two weeks of data collection. Neither child was able to speak English.

Child No. 1 was a female, 4.8 years old at the time of data collection. Figure 11 illustrates both her social behavior and the mean in each category. During the seven week data collection period, it can be noted that the amount of time she spent in solitary play steadily increased by 21%. The percentage of time spent in parallel play was within the range of behavior exhibited by the whole group but was 10-16% greater than the means established for children in her age group. The amount of time spent in group interactions was 20-32% less than the group means, and 24-38% less than those in her age group. Of particular interest was the amount of watching behavior exhibited by this child. She is coded as watching 28% of the time observed during Time 1 when the mean percentage of watching behavior for the whole group was 4.1%. In Time 3, the percentage of her watching behavior had dropped to 6%,

Table 14

Mean Percentage of Social Interaction for Two Children

	Solitary	Parallel	Group	Watching	Transition
Child No. 1					
Time 1	5	23	40	28	1
2	14	26	44	11	1
3	26	29	33	6	1
Mean Room A	8.9	18.2	65.4	3.8	1.2
Child No. 7					
Time 1	24	15	51	6	1
2	45	20	25	4	4
3	41	8	42	0	5
Mean Room B	13.8	12.0	66.4	3.5	2.7

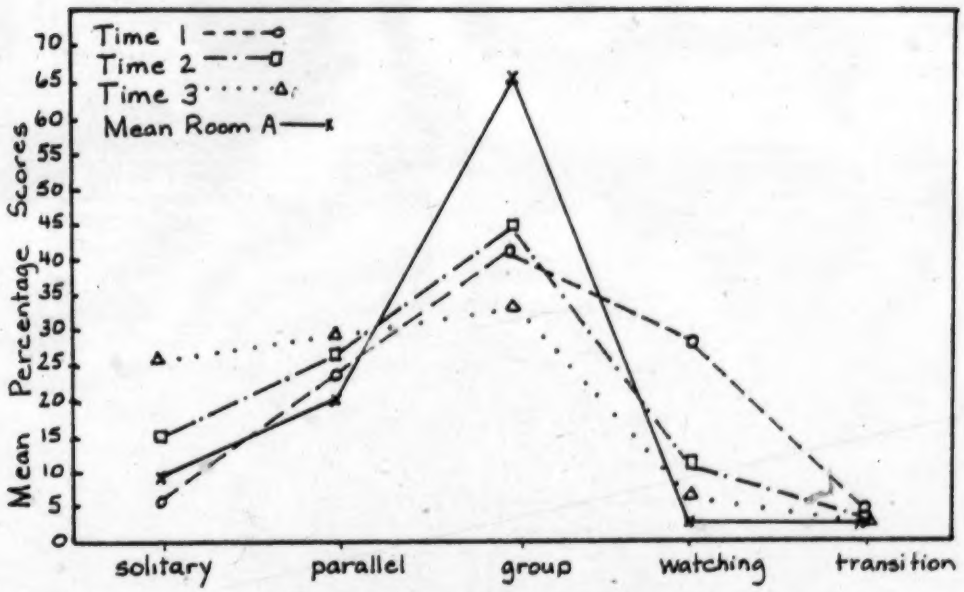

Figure 11. Mean percentage scores for Child No. 1 over three time periods and mean percentage scores for Room A.

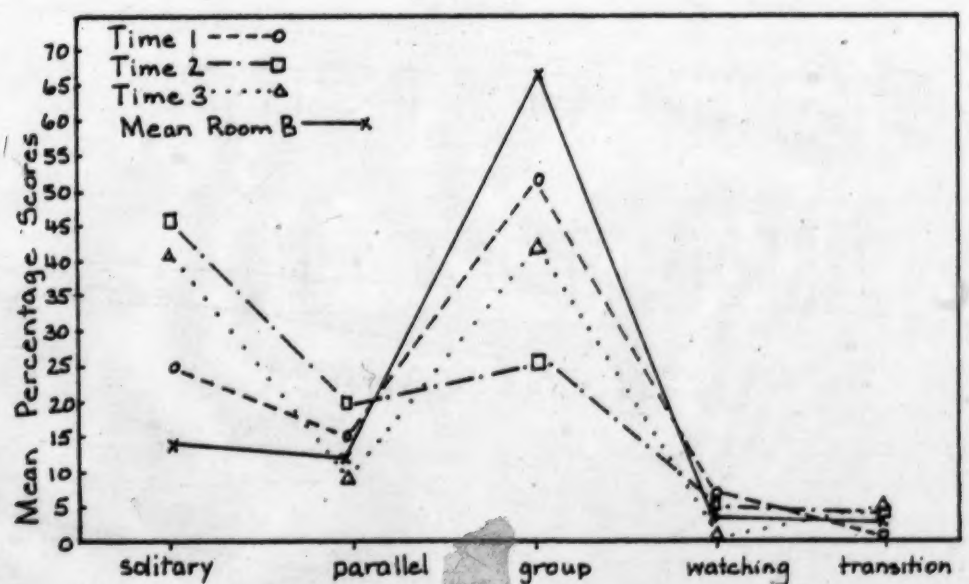

Figure 12. Mean percentage scores for Child No. 7 over three time periods, and mean percentage scores for Room B.

while the group mean was 3.5%.

The second child, Child No. 7, was a male, 3.3 years old at the time of data collection. Figure 12 illustrates his social behavior and the mean in each category. The child showed high levels of solitary behavior and very low levels of group interaction which changed coincident with the changes in density condition. He showed levels of solitary behavior which were 12-32% above the group mean, and levels of group interaction which were 15-39% lower than that of the whole group. No notable differences were found for parallel interactions, watching, and transitional behavior.

The behavior of individual children show large differences based on idiosyncratic behavior patterns. The effect of variations in environment may be more salient for some individuals than for others, and personal characteristics may mediate the effects of environment.

Social Interaction By Setting

An analysis was made of social interaction by setting in each of the three rooms. The data from Room C is presented in Table 15, the data from Room A is presented in Table 16, and the data from Room B is presented in Table 17. Each table shows the mean percentage of social interaction in each category by setting for the three time periods. As well the mean setting use figures are shown. In all three rooms the majority of comparisons between time periods involve changes of less than 5%.

In order to determine if changes in spatial density affected the types of social interaction which occurred in specific settings, only three settings in which change in density was most likely to have

Table 15

Mean Percentage of Social Interaction, by Setting for Three Time Periods
Room C

Setting	Social Category: Solitary 1	Solitary 2	Solitary 3	Parallel 1	Parallel 2	Parallel 3	Group 1	Group 2	Group 3	Watching 1	Watching 2	Watching 3	Transition 1	Transition 2	Transition 3	Mean Setting Use 1	Mean Setting Use 2	Mean Setting Use 3
Bathroom	4.2	2.4	1.8	1.2	0.0	0.0	0.4	0.3	0.1	0.0	1.0	0.0	1.5	1.4	5.7	0.7	0.5	0.4
Sink	7.5	5.7	8.5	5.0	2.4	5.1	0.9	1.0	1.2	0.0	0.0	1.6	0.0	1.4	0.0	1.6	1.0	1.9
Craft Area A	5.1	8.1	7.9	4.6	1.7	1.7	4.4	5.3	6.0	4.4	2.1	4.8	21.5	1.4	0.0	4.7	4.5	5.6
Craft Area B	11.7	8.9	0.6	1.5	2.4	1.7	5.1	7.9	5.1	4.4	3.1	4.8	6.2	11.6	17.0	5.0	6.5	4.3
Big Loft	2.3	2.4	6.1	1.2	1.0	0.0	4.6	1.2	2.1	4.4	0.0	0.0	1.5	0.0	0.0	3.4	0.9	2.1
Little Loft	9.3	6.9	1.8	1.9	1.4	0.0	2.3	4.4	1.6	26.5	11.5	12.7	1.5	0.0	1.9	3.2	3.9	1.9
House Area	8.9	6.5	17.7	7.3	0.7	17.9	4.8	2.1	7.8	1.5	1.0	12.7	0.0	1.4	11.3	5.0	2.1	9.1
Block Area	8.4	10.5	6.5	27.4	21.8	45.3	24.2	22.3	26.4	25.0	21.9	28.6	10.8	15.9	11.3	23.6	20.5	25.9
Table Toys	2.8	4.9	6.1	3.5	21.8	5.1	4.5	10.5	6.5	4.4	8.3	0.0	21.5	30.4	17.0	4.6	11.8	6.1
Book/Music	13.6	10.9	11.0	8.5	8.5	1.7	10.4	7.4	9.4	1.5	1.0	0.0	4.6	5.8	1.9	9.1	7.6	8.0
Little Blocks	11.7	6.5	6.1	5.0	5.8	1.7	3.7	8.0	5.0	0.0	5.2	3.2	4.6	0.0	1.9	4.2	7.5	4.8
Scrap Table	7.9	4.9	6.1	10.4	6.5	3.4	13.6	8.2	11.2	10.3	11.5	7.9	1.5	2.9	3.8	11.5	7.4	9.5
Natural Materials	3.7	14.2	7.3	2.7	8.5	1.7	1.2	5.0	4.2	2.9	5.2	3.2	15.4	24.6	11.3	2.4	6.5	4.1
Snack/Craft Area C	2.8	7.3	11.0	19.7	17.7	14.5	19.5	16.4	13.3	14.7	28.1	20.6	9.2	2.9	17.0	16.6	15.0	13.5

Table 16

Mean Percentage of Social Interaction, by Setting for Three Time Periods
Room A

Setting \ Time	Solitary			Parallel			Social Catetory Group			Watching			Transition			Mean Setting Use		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Bathroom	6.3	4.4	5.7	3.6	4.9	6.4	1.1	0.6	0.8	1.0	0.5	0.8	5.3	4.1	0.0	1.9	1.5	2.1
Water Table	3.2	4.7	5.7	1.1	0.3	1.5	2.4	2.7	1.4	1.5	0.0	0.0	7.0	2.7	4.7	2.3	2.3	2.5
Craft Area A	11.2	10.1	5.7	8.9	6.6	3.6	17.2	12.0	8.7	19.2	16.4	11.3	21.1	12.3	0.0	14.0	10.9	7.1
Under Loft	3.4		1.2	1.9		2.6	3.4		7.8	3.0		4.5	5.3		9.3	6.9		5.7
Little Loft	2.3	4.4	3.0	3.0	1.6	0.6	2.0	2.8	1.6	0.5	1.9	0.8	1.8	1.4	0.0	2.1	1.3	1.3
Big Loft	9.2	8.6	8.4	4.2	5.1	4.7	9.7	13.6	6.8	5.1	4.2	9.8	1.8	2.7	0.0	7.9	8.6	6.6
Blocks Area	10.3	16.0	4.5	6.9	8.8	10.0	8.8	13.3	28.0	10.1	7.9	19.5	0.0	9.6	7.0	8.8	11.9	19.3
House Area	9.2	8.6	6.9	8.4	4.8	4.2	5.4	9.0	8.4	6.1	3.7	3.8	1.8	5.5	0.0	5.9	7.6	6.9
Felt Board	2.9	1.5	0.6	0.3	1.0	0.6	1.2	0.5	0.5	1.5	0.5	6.8	8.2	2.6	11.6	1.0	0.4	0.7
Book/Music	17.5	11.6	25.3	9.5	13.0	11.0	13.4	10.5	11.4	6.6	8.8	15.0	15.3	16.4	27.9	11.8	11.1	12.5
Table Toy Area	10.6	7.9	9.0	18.1	20.7	15.3	14.2	15.4	6.7	14.1	19.6	8.2	1.8	19.2	14.0	14.1	16.1	8.1
Sand Table	2.6	0.7	3.3	0.3	0.3	0.5	1.1	0.4	0.6	2.5	3.3	1.5	0.3	0.5	3.0	1.1	0.5	0.8
Snack/Puzzle	3.4	6.9	6.0	26.0	23.4	34.1	8.1	10.8	6.3	8.1	7.9	3.8	8.8	8.2	4.7	11.0	12.3	10.3
Craft Area B	6.3	7.9	8.4	5.9	8.9	3.4	12.9	8.0	10.1	15.2	24.2	11.3	17.5	15.1	7.0	10.6	9.3	7.6
Teacher Storage	0.6	4.9	1.8	0.5	1.6	0.4	0.3	0.4	0.1	1.5	0.5	0.0	1.8	0.0	0.0	0.4	0.8	0.4
Easel	1.1	1.7	4.2	1.6	0.6	0.4	0.4	0.0	0.3	0.3	0.5	3.0	1.8	0.0	7.0	0.7	0.4	0.8

Table 17

Mean Percentage of Social Interaction, by Setting for Three Time Periods
Room B

Setting	Solitary			Parallel			Group			Watching			Transition			Mean Setting Use		
Time	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Bathroom	8.9	7.4	7.8	1.6	3.8	1.1	0.7	1.1	0.7	1.3	4.6	0.0	5.7	3.8	4.5	1.6	2.8	1.7
Water Table	7.8	17.0	12.1	0.3	0.6	0.0	5.4	0.7	4.1	7.3	0.0	4.3	0.0	0.0	3.4	4.7	3.0	4.5
Craft Table A	11.1	3.2	5.8	24.6	27.9	29.1	14.6	12.4	14.3	11.3	12.3	15.2	15.7	18.9	7.9	15.2	13.4	13.5
Fisher-Price Toys	8.4	5.7	9.0	3.7	4.8	7.4	4.0	2.8	5.6	3.3	9.2	0.0	1.4	24.5	5.6	4.0	3.9	6.0
Little Loft	6.7	10.6	7.2	1.9	2.9	2.6	1.4	4.3	2.1	1.2	3.1	2.2	2.9	0.0	1.1	1.9	4.5	3.0
Blocks	7.8	6.0	5.2	24.6	7.1	14.3	20.6	9.1	15.9	21.9	12.3	21.7	10.0	11.3	6.7	18.1	8.5	14.8
Access Area	2.2	2.5	3.8	1.6	4.2	2.1	2.6	8.0	4.0	9.9	1.5	0.0	22.9	18.9	22.5	3.1	4.2	4.6
House Area	1.9	3.5	2.9	2.4	5.8	6.9	4.5	9.4	6.6	1.3	3.1	6.5	1.4	0.0	2.2	3.3	5.4	5.5
Music/Book Area	9.2	4.6	6.6	14.0	21.8	16.4	3.2	0.7	4.4	4.0	0.0	6.5	2.9	5.7	2.2	4.9	8.8	5.1
Table Toy	3.6	6.4	5.8	9.8	4.8	3.7	6.2	6.5	5.0	2.6	3.1	4.0	2.9	0.0	0.0	6.3	7.3	4.3
Access Area	1.7		5.8	0.5		2.6	0.4		0.8	1.3		4.3	11.4		0.0	0.6		2.4
Playdough	8.6	8.2	3.5	0.3	0.3	0.0	5.1	4.5	9.3	4.0	0.0	2.1	1.4	0.0	3.4	4.4	4.1	6.5
Craft Table B	9.7	3.5	3.8	8.5	4.8	5.8	12.9	19.3	15.5	7.9	33.8	8.7	14.3	15.1	19.1	12.1	15.2	11.8
Sand Table	6.7	18.1	12.1	2.1	1.9	0.5	13.9	10.9	7.2	11.3	13.8	8.7	1.4	0.0	1.1	10.9	10.1	6.9
Teacher Storage	0.8	0.0	0.0	1.1	0.3	0.5	0.1	0.1	1.2	0.0	0.0	0.0	2.9	1.9	0.0	0.3	0.2	0.4

occurred will be discussed. These are the Block Area, the House Area, and the Music/Book Area. Density manipulation in other areas of the rooms was subject to both space restraints and limited access by the children. For example, centers which used tables and chairs were forced to maintain a certain spatial area to accommodate the equipment. Only a certain amount of spatial manipulation could occur. Certain areas such as the Bathroom, the Big Loft, and the Little Loft were not changed in spatial size during the data collection period. Other areas such as the Sand Table and the Water Table were limited to two children, and this restriction limited changes in use patterns. The patterns of social interaction in the Block Area, the House Area, and the Music/Book Area will be examined in Room C first, and then the patterns in Room A and Room B will be examined.

Block Area

In the Block Area in Room C, overall use of the setting declined 3.1% between Time 1 and Time 2, and increased 5.4% between Time 2 and Time 3. The largest differences in social interaction occurred in parallel, watching and transition. For parallel play there was a decline of 5.6% between Time 1 and Time 2, and an increase of 23.5% between Time 2 and Time 3. For watching behavior, a decline of 3.1% occurred between Time 1 and Time 2 and an increase of 6.7% occurred between Time 2 and Time 3. The variations in these two categories follow a decrease/increase pattern which is also found in the pattern of setting use. Transitional behavior varies from this pattern and shows an increase of 5.1% between Time 1 and Time 2, and a decrease of 4.0% between Time 2 and Time 3.

In Room A, the pattern of Block Area use for the whole group shows an increase of 4.2% between Time 1 and Time 2, and another increase of 7.4% between Time 2 and Time 3. This pattern was followed for the variations in group activity which showed an increase of 4.5% between Time 1 and Time 2, and an increase of 14.7% between Time 2 and Time 3. For solitary and transition behavior a pattern of increase/decrease occurred, and for watching a pattern of decrease/increase occurred. Solitary behavior increased 5.7% between Time 1 and Time 2, and decreased 11.5% between Time 2 and Time 3. Transitional behavior increased 9.6% between Time 1 and Time 2 and decreased 1.4% between Time 2 and Time 3. Watching behavior decreased 2.2% between Time 1 and Time 2, and increased 11.6% between Time 2 and Time 3.

In Room B, mean use of the Block Area decreased 9.6% between Time 1 and Time 2, and increased 6.3% between Time 2 and Time 3. The same pattern of variations occurred for parallel play which decreased 17.5% between Time 1 and Time 2, and increased 7.2% between Time 2 and Time 3, for group play which decreased 11.5% between Time 1 and Time 2 and increased 6.8% between Time 2 and Time 3, and for watching behavior which decreased 9.6% between Time 1 and Time 2, and increased 9.4% between Time 2 and Time 3.

In the Block Area the variations in the types of social interaction which occurred are of the same and greater magnitude in Room C than those in Room A and Room B. The patterns of variation vary most from the pattern of setting of use in Room A and are the most stable in Room B. No patterns specifically related to density were found.

The House Area

In the House Area in Room C, mean use of the setting decreased 2.9% between Time 1 and Time 2, and increased 7.0% between Time 2 and Time 3. Changes of more than 5% occurred in all social interaction categories. Solitary behavior decreased 2.4% between Time 1 and Time 2, and increased 11.2% between Time 2 and Time 3. Parallel behavior decreased 6.6% between Time 1 and Time 2 and increased 17.2% between Time 2 and Time 3. Group behavior decreased 2.7% between Time 1 and Time 2 and increased 5.7% between Time 2 and Time 3. Watching behavior decreased .5% between Time 1 and Time 2 and increased 11.7% between Time 2 and Time 3. Transitional behavior varied slightly and an increase of 1.4% was found between Time 1 and Time 2, and another increase of 9.9% was found between Time 2 and Time 3.

In Room A, the only variation which was greater than 5% occurred in transitional behavior which showed an increase of 3.7% between Time 1 and Time 2, and a decrease of 5.5% between Time 2 and Time 3.

No changes greater than 5% occurred in the House Area in Room B.

The variations which occurred in the Control Room, Room C, were greater than those found in either of the experimental rooms in the House Area. Behavior in Room A and Room B was very consistent over the data collection period.

Music/Book Area

In Room C, the only variation greater than 5% in the social interaction which occurred in the Music/Book Area was in parallel be-

havior. No change occurred between Time 1 and Time 2 but a decrease of 6.8% was found between Time 2 and Time 3. No change greater than 5% was found in Room C in the pattern of setting use for the Music/Book Area.

In Room A, the pattern of setting use for the Music/Book Area was fairly stable though there were variations in solitary, watching, and transitional behavior greater than 5%. Solitary behavior increased 4.1% between Time 1 and Time 2 and increased again 13.7% between Time 2 and Time 3. Watching behavior showed the same pattern and increased 2.2% between Time 1 and Time 2, and increased 6.2% between Time 2 and Time 3. The same pattern was followed for transitional with an increase of 1.1% between Time 1 and Time 2 and an increase of 11.5% between Time 2 and Time 3.

The only variation greater than 5% in social interaction in Room B in the Music/Book Area was for parallel play. Parallel play increased 7.8% between Time 1 and Time 2, and decreased 5.4% between Time 2 and Time 3.

Variations in density do not appear to affect the variations in social interaction by setting when compared to the variations which occurred in the Control Room. Variations in the experimental rooms were more stable than those found in the Control Room. Variations in social behavior generally followed patterns of use, and increased when use increased and decreased when use decreased. The categories which showed incongruent patterns of social behavior as compared to patterns of setting use were most frequently solitary and transitional behavior.

The settings in which the social interaction occurred most frequently are described by room.

Room C When the percentage of social interaction was analyzed by setting and by condition, it was found that for parallel and group interactions, the behavior was most frequent in the Block Area, and that this was consistent across all conditions. Solitary behavior was most prevalent in the Music/Book Area in Time 1, the Natural Materials Area in Time 2, and the House Area in Time 3. Watching behavior was most frequently observed in the Little Loft in Time 1, Craft Area C/ Snack Area in Time 2, and in the Block Area in Time 3. Transitional behavior occurred most frequently in the Table Toy Area in all three time periods and in Craft Area A in Time 1 and Craft Area B and Craft Area C/Snack Area in Time 3. From the group means for setting use it may be noted that the highest level of setting usage was found in the Block Area.

Room A Parallel interactions were highest at the Snack/Puzzle Table during the data collection period for all time periods. Solitary behavior was most prevalent in the Music/Book Area in Time 1, in the Block Area in Time 2, and again in the Music/Book Area in Time 3. Group interactions occurred most frequently in Time 1 at Craft Area A, in Time 2 at the Table Toy Area, and in Time 3 in the Block Area. Watching was observed most frequently in Craft Area A in Time 1, Craft Area B in Time 2, and in the Block Area in Time 3. Transitional behavior was most prevalent in Craft Area A, the Table Toy Area, and the Music/Book Area for Times 1, 2, and 3 respectively.

Room B Solitary behavior was noted most frequently at Craft Table A in Time 1, the Sand Table in Time 2, and both the Sand Table and the Water Table in Time 3. Parallel interactions were highest at Craft Table A

during all time periods as well as the Block Area during Time 1. Group behavior was most prevalent in the Block Area in Time 1 and Time 3, and at Craft Table B in Time 2. Watching occurred most frequently in the Block Area in Time 1 and Time 3, and at Craft Table B in Time 2. Transitional behavior was observed most frequently in the Open Area in Time 1 and Time 3 and in the Fisher-Price Toys in Time 2.

Variations in the settings in which specific types of social interactions occurred may be related to variations in spatial area. The patterns which occurred in the control room are much more stable than those in either of the experimental rooms. Particularly in Room B, group, watching, and transitional behavior are most frequent in the same settings in Time 1 and Time 3, but vary in Time 2. These changes may be related to variations spatial density.

In this chapter, the findings of the data analysis with respect to setting use, setting-specific behavior, and social interaction have been presented. Variations in spatial density have only a limited and inconclusive effect on children's behavior in a day care setting. Behaviors which may have resulted from the impact of spatial density change were discussed. Other factors examined were room, sex and age. Conclusions and implications of the findings will be discussed in Chapter Five.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

The research study which is described here was an attempt to gain an understanding of one aspect of the relationship between man and the environment. The perspective used is derived from a model of man and environment as independent but mutually interacting systems. The interactionist position acknowledges the formative influence which each variable exerts on the other, yet the independent nature of man and environment allows each aspect of the relationship to be studied separately. The influence of the environment in terms of density, or the amount of space available per child, on specific behavior categories exhibited by children in a day care setting was the focus of this study of man-environment interactions.

It has been established that the environment acts as a coercive force on the determination of behavior. Research on the effects of the spatial environment, in particular, variations in density, indicate that dentisy may be an important environmental factor in determining the behavior of children in preschool groups.

Three groups of children which comprised the population of three day care classrooms were used in this study. The floor area in two of the rooms was reduced during the middle three weeks of a seven week data collection period to increase the density of the rooms. The children in the third room had access to the same amount of space throughout the data collection period. A room scan methodology was

used to gather information on children's use of space, the activities of the children within the space, and the social interactions engaged in by the children. All findings in the two experimental rooms were compared to those in the control room to establish differences which might be related specifically to the effects of density. Other variables which were considered important were room, sex, and age. Because these were found to have important effects independently and in interaction with the density effects, findings for these variables were also reported.

The findings of the study and the conclusions with respect to the findings are discussed in relation to the research questions.

Question 1

Will the percentage of time spent in each setting during free play in a day care room differ according to density condition for:

1.1 the total group?

1.2 males and females?

1.3 older and younger children?

Patterns of setting usage indicated that children were not consistent in their use of settings and that there were large individual differences in setting usage during the data collection period. These patterns did not appear to be directly influenced by variations in density as the type of changes observed in the control room were not markedly different from those in the experimental rooms. Preference for settings as indicated by a high percentage of setting usage involved the same settings in all three rooms with slight variations in the order of preference. Sex and age may be influential in determining

setting preference.

Question 2

Will the percentage of time spent in setting specific behavior and non-setting specific behavior during free play in a day care room differ according to density condition for:

2.1 the total group?

2.2 males and females?

2.3 older and younger children?

A high level of setting specific behavior was found when activities within each setting were observed. This finding was consistent across density condition, across rooms, and across sex and age groupings.

Question 3

Will the percentage of time spent in solitary, parallel, group, watching, and transitional activities during free play in a day care room differ according to density condition for:

3.1 the total group?

3.2 males and females?

3.3 older and younger children?

Social behavior was coded into three interactive categories, solitary, parallel, and group, as well as two related categories, watching and transitional behavior. The patterns of social behavior were similar in the control room and the experimental rooms suggesting that there was no direct influence of variations in density on children's social behavior. Individual data showed that there were wide variations

between children and across time for individual children in the categories of social behavior in which they engaged. Children were involved in group interactions the majority of the time with solitary and parallel behavior accounting for a smaller percentage of the observed behavior. Watching and transitional behavior were coded only a small proportion of the time. Minor modifications in this pattern were seen between rooms, and in differing sex and age groupings.

An analysis of social interaction categories by setting indicated that the amount and variation of social interaction within settings followed the amount and variation of setting use. This was consistent across rooms and independent of density. Categories where patterns were inconsistent most frequently were solitary and watching behavior. This occurred in both the control and experimental rooms. The most frequent occurrence of specific types of social interaction in specific settings seemed to fluctuate more in the experimental rooms than in the control room and may have been related to spatial manipulations.

The conclusions which may be drawn from the findings presented are that variations in density within the mean range of 3.5 m^2/child to 6.2 m^2/child were not directly influential in determining the patterns of setting usage, the amount of setting specific behavior, and types of social interaction exhibited by children in a day care setting.

A discussion of the findings will follow.

A. Discussion of the Findings

The study described was one segement of a research project in-

vestigating the effects of variations in density in a day care center. Another segment of the project included interviews with staff members at the day care center as to their perceptions of the effects of variations in density on the children they supervised. Throughout the discussion of the findings reference will be made to the interview findings (See Appendix A).

The findings presented suggest that the variations in density produced in this study as a function of changes in the amount of space available did not produce behaviorial changes in preschool children which differed markedly from the normal variations present in young children's behavior patterns. This result was found in patterns of setting usage, of setting specific behavior and of social interactions. The control room showed as much variation as that found in the experimental rooms and, in fact, there was more variation in the control room than in Room A. These findings may suggest that other factors are more influential in determining children's behavior than the spatial environment, and density, in particular.

Several factors should be considered when the findings from this research are examined. Because of the variation in the number of children present during the data collection period, not only did the children experience a change in spatial density but also in social density. It had been suggested previously that the two different types of density manipulations may have different effects on the behavior of children. The patterns of behavior found in the experimental rooms may be a result of the two changes occurring simultaneously and not indicative of the effects that may be found if only one variable of

density, either space or group size, is manipulated.

The variation in attendance also affected the absolute density which was achieved. The purpose of reducing the space was to produce a density of 2.7 m^2/child in each of the experimental rooms as compared to 4.3 m^2/child in the control room and in the experimental rooms using the original space. The density in the experimental room would be within the category of high density (less than 3.0 m^2/child), while the density in the control room would be within the category of medium density (3.1 to 4.5 m^2/child) and approaching low density (more than 4.6 m^2/child). Because of the variations in attendance, the mean density during Time 2 in the experimental rooms was 3.5 m^2/child and 3.8 m^2/child,well within the classification of medium density, and the mean density for the three rooms when the total space was used ranged from 5.3 to 6.2 m^2/child, well with the classification of low density. According to the advocacy literature in the field, all of the density levels used in this study would be considered adequate for children in preschool groups.

There is evidence reported in the literature that an increase in density does affect setting usage (Rohe & Nuffer, 1977) and social interactions (Bates, 1970; Price, 1971; Loo, 1976). The effects of an increase in density may only be felt at a specified density above which children feel crowded and react to the feelings of crowdedness. Both Smith & Connolly (1976) and(Loo 1976) suggest the existence of a critical density level. Smith and Connolly also propose that the critical level may change for specific behaviors. They report that the effects of density on the suppression of rough and tumble play begins at 4.8 m^2/child, although aggressive behavior does not appear

to be influenced until the density reaches 2.4 m^2/child. The density levels attained in this research study may not approach the critical levels related to setting use, setting specific behavior and social interaction, and, therefore, no variations in behavior may be attributable to the effects of increased density. Research which would achieve higher density levels is necessary to clarify this issue.

The similarity between the behavior in the control and the experimental rooms suggests that actual amount of space, at least within certain limitations, may not be a significant factor in the determination of children's behavior. Spatial area may have indirect effects on children's behavior in that certain types of program decisions will be made as a result of the availability of sufficient space. In Time 2, in the experimental rooms, care was taken to ensure that the amount of space available was adequate to retain the same amount of equipment and furniture, so that only minimal program changes were necessary. A smaller spatial area would have required that furniture and equipment be removed, which would have limited the type of activities in which the children could participate.

Questions which are pertinent to this discussion center on how much space is necessary to maintain a high standard of social interactions and play behaviors. In this study, when the space was reduced, there was a coincident and unplanned reduction in the number of children who used the space. The space/child ratio was not reduced in proportion to the reduction of the spatial area. During this period, it was noted that the behavior patterns of setting usage and social interaction were not notably different than those in the regular space. These results

may suggest that in a small spatial area, it is necessary to reduce the number of children in the area to maintain the patterns of behavior. In order to verify this hypothesis it would be necessary to determine whether behavior patterns would change if there was no corresponding reduction of density when the space was reduced.

Behaviorial Consistency

Behavior patterns of both individual children, and groups of children show considerable variety during the seven week data collection period. This finding is inconsistent with other research which has found that children show stable behavior patterns over short periods of time. Roper and Hinde (1978) found that patterns of social interactions which focused on solitary, group, and unoccupied interactions showed considerable stability for three- to five-year old children over a three month period. Rose, Blank, and Spalter (1975) also found that for a variety of measures including amount of interactions and quality of interaction that children three- to six-years old manifest stable behavior patterns during free play during a four-month period.

When the findings for group means in this study were compared with those found by Massing (1979) in Room C of the same day care center, there was a high level of consistency in patterns of setting usage, solitary, watching, and transitional behavior. Massing did not study parallel or group interactions.

Massing concluded from her data which was collected over a three week period, that children showed a wide variation in setting usage across the range of settings and for the different settings across the range of children. The present study found that not only did

children vary widely in their setting preferences, but also that setting preference as indicated by setting use varied over time. The consistency which was found by Roper & Hinde, and by Rose, Blank & Spalter is not apparent in the findings of this study. Yet even though there have been changes in the sample and in the room, the comparisons between the present study and Massing's, nine months apart, show a high level of consistency. This may suggest that over a longer period of time, trends in behavior patterns became stabilized and show a greater level of consistency than those analyzed over a shorter time period.

Staff Reactions

Observations made by staff members led them to conclude that there were definite changes which occurred during the period of time when the spatial area was reduced. These conclusions were not, as a rule, born out by the room scan data. These discrepancies may be an indication that the variables studied were not the ones influenced by the change in space or that the variables were not defined in such a way as to distinguish between distinctions within a category. Setting usage was defined as presence within a setting. There was no attempt made to actually define the activities which occurred within a setting. Data from the room scan show that there was no notable difference between the percentage of setting use in the Block Area from Time 1 to Time 2. Staff observation during those two periods indicated that the setting was used quite differently. In Time 1 the main activity consisted of construction with large blocks. In Time 2, the Block Area was moved to the area underneath the loft. The most distinct difference between the Block Area in the two conditions was that in Time 2 the Block Area acquired a "roof" (the bottom of the Big Loft). Play in

Time 2 frequently consisted of children hanging blankets from the Big Loft platform, in effect, making walls. This area was then used occasionally as a house, and dramatic play of the type usually associated with the House Area occurred here. This type of information was not picked up by the room scan.

All the staff members focused on the increased frequency of aggressive behavior which occurred in Time 2. Aggressive behavior can generally be categorized as a group interaction as it usually involves two or more people. There was no distinction made as to the positive or negative nature of the interactions in the methodology used. This distinction may have offered valuable information as to the effects of spatial variations on children. Aggression, and other types of agonistic interactions, have frequently been used as the dependent variable in density studies.

Other factors which may be responsible for the discrepancies include differing length of the observation period and the effect of previous knowledge of children's behavior patterns. Firstly, the staff based their conclusions on the activities and behavior observed throughout the whole day in the child care center. The data from the room scan were gathered during one hour of free play each morning. The children may have exhibited different behaviors during other times of the day or in other situations. In this case, conclusions drawn would be based on a different data base. Secondly, the staff may also have been using previous knowledge of the children's behavior patterns as a basis for making comparisons between the regular and the reduced space. This type of knowledge may have provided the staff with additional information which was not available through the room scan.

Comparisons then would have been made using different information. Finally, the personal bias of the staff may have influenced their perceptions of the children's behavior. Many of the staff stated that they found the reduced spatial area produced greater feelings of tension, fatigue and irritation. Adults may have negative reactions to the smaller spatial area and transfer their feelings onto the children. Perceptions of increased aggression and disruptive behavior may be the result of lower tolerance for deviant behavior and closer proximity to the children. These hypotheses are speculative and more information would be needed to substantiate their validity.

Several staff members suggested that in a smaller space the role of the teacher would be more directive and that there would be less opportunity for children to make activity choices. Fagot (1977) reports this to be true in more crowded schools where teachers were more directive. Perry (1977) also found that teachers in classrooms with less than 2.9 m^2/child were more directive than teachers who worked in lower density rooms. The effect of variations in density on teachers' behavior may indirectly influence the behavior of children.

Setting Usage

While setting usage varied between, and across, time, the popularity of certain centers was consistent even though the rank order of setting preference changed. The settings which received high levels of use in all rooms were in Block Area, the Craft Areas, and the Book/Music Area. The patterns of setting use are similar to those found by Shure (1963) in that the Block Area and the Art or Craft Areas were the most popular. Shure found that the Book corner was the least popular

area in her study. The popularity of the Book/Music Areas in the present study may be due to the combination of activities which were available to the children. They had access to records and books and there was sufficient room to engage in dance and creative movement.

Shure has suggested that popularity in terms of setting use is related to the size of setting. In her study the Block Area was the largest and the Book Area was the smallest in physical size. In the present study, in all conditions, the Block Area and the Book/Music Area were the two largest settings in all three rooms. The Craft Areas which received extensive use were much smaller in size. The physical size of a setting may only be one factor which contributes to the attactiveness of a setting. An interrelationship between size and activity may be an important factor in determining setting preference such that a setting which is sufficiently large to accommodate the activities associated with it contributes to the attractiveness of that setting.

Several researchers have found higher levels of use of the Block Area by males and of the Art Area by females (Rubin, 1977; Tyler, 1975: Shure, 1963). The pattern of high Block Area use and high Art Area use by females was only partially followed in the present study. In Room C, males were more frequently observed in the Block Area than females, and it was also the area which received the highest use by males. Females used the Craft C/Snack Area most frequently during the five weeks of data collection but were seen most often in the Block Area during the final two weeks of observation. In Room A, the most popular setting for males was the Table Toy Area during Time 1 and Time 2 but during Time 3 they were most frequently observed in the Block Area. Females followed a similar pattern but were most frequently observed

in a Craft Area in Time 1 and Time 2, and in the Block Area in Time 3. In Room B, males were observed most frequently in the Block Area during Time 1 and Time 3, but in Time 2, the Sand Area was the most popular. Females showed consistently high levels of use of the Craft Areas.

While there was a tendency for males to use the Block Area more, and for females to use the Craft Areas more, there is some cross-over, particularly in female use of the Block Area. Kinsman and Berk (1979) found in a study of children's use of house and block settings that there was no evidence of sex-typed attraction to settings, and that all children preferred the Block Area. The attraction of the Block Area seemed to appeal to most children and its influence may be noted in the setting use patterns found in this study.

Cohen, Hulls, and Rhine (1978) found patterns of setting use related to age. Younger children (3 year olds) preferred the Block Area, the Sand Table, and the Small Manipulative Area. Older children (4 year olds) preferred Arts and Craft Areas. These preferences were similar to those found in Room B, though the age divisions do not correspond directly. Older children in this study (4 1/2 - 6 year old) preferred the Block Area and the Sand Table, though in Time 2 they were observed more frequently in the Craft Area. In Room C, this tendency was also prevalent with the younger children showing a market preference for the Block Area, and the older children showed a slight trend towards preferential use of the Craft setting except in Time 3 where the Blocks were the most popular area. The children in Room A did not show preferential use of settings related to those found by Cohen, Hulls, and Rhine. Differing definitions of age group cause any conclusions to be

of a tentative nature.

All staff members stated that to operate a program in a space the equivalent of the area available during the experimental period they would remove some equipment or furniture. Several suggested a rotation of settings available to the children. Some of the staff complained that in the smaller space both adults and children were always bumping into furniture and into each other. These observations correspond with the findings of Kritchevsky, Prescott, and Walling (1969) that it is necessary to have at least one third of the floor space uncovered in order to provide ease of movement. To remove settings in order to provide the necessary uncovered space requires a careful analysis of the activities which are considered necessary on an everyday basis and those which could be provided on a rotating basis. The basis for these decisions will be an understanding of children's use of space, the activities which occurred in each setting and the needs of the children which can be facilitated by environmental organization. An analysis of setting usage patterns would indicate the settings which were receiving the highest levels of use and suggest which settings may be superfluous.

For all the rooms, between 45% and 62% of the children's time was spent in 26% of the settings available. This suggested either that some of the areas were not attractive enough to encourage children's use, or that they serve only a utilitarian purpose. Areas such as the Bathroom and the Teacher Storage had specific uses which would limit the amount of use they received. Some of the settings had limits as to the number of children who could be present at one time. The Water Table, the Sand Table, and the Big Loft were all restricted to two or

three children. Mean percentage of use in these areas would not be an accurate measure of the popularity of the setting.

Other settings which are usually found in preschool programs received limited use, such as the Paint Easels in Room A and Room C. Surprisingly, the House Area, which is considered to be a traditional part of early childhood programs (Kinsman & Berk, 1979) received low levels of use. In the Kinsman and Berk study, 13% of the children's free time was spent in the House Area. In this study in Room A, B and C,6.6%, 4.5%, 4.8%, respectively, of the children's time was spent in the House Area. In each room the House Area was quite different. In Room C, the House was located underneath the Loft, and adjacent to the Block Area. In Room B, a Wendy House framed the boundaries of the House Area. In Room A, one corner of the room bounded by cupboards and shelving units was used as the House Area. Each setting contained similar equipment. In each case the setting was fairly large in area. There appeared to be no common factor present in rooms which accounts for the low levels of use.

While actual percentage of setting use may serve as one criterion measure to be considered when removal of settings is considered, the aims and objectives of each setting must be analyzed. If a setting is organized to provide opportunities for solitary pursuits, a low percentage of setting use may not be a useful measure of the effectiveness of that setting.

The analysis of social interaction by setting may give valuable information as to the behavior generated within specific environments. Areas which are popular in terms of percentage of use spawned different types of social behavior. High levels of solitary

play occurred in the Music/Book Area in Room A and Room C, while high levels of group interactions occurred in the Block Areas in Room B and Room C. Generally, in areas which had high levels of use, high levels of each category of social behavior occurred. Occasionally, though, it was found that an area such as the Water Table in Room B and the House Area in Room C which had low use levels showed high levels of a social behavior, in this case, solitary play. If solitary play is considered to be important, then settings which seem to foster this type of behavior may be necessary in a preschool setting.

Setting Specific Behavior

The high levels of setting specific behavior confirm the coerciveness of environmental settings in determining behavior. Children in all age and sex groupings, and regardless of room or density condition indicated that they were aware that specific activities were associated with specific settings, and exhibited a high degree of behavior-milieu synomorphy. Several factors which Barker lists as influential in developing behavior milieu synomorphy were observed to be operating in the day care rooms. Physical arrangement of furniture influenced behavior such that a table set beside a shelf of table toys used as a place to play with the table toys, and passage ways were used most frequently for transitional activities. Staff expectations and social norms were influential in categorizing behavior within a setting as appropriate or not. In areas where limits were set on the number of children who could be present in a setting, children were observed to note the number of children in a setting and, if the quota had been reached, to choose another activity. They were aware of the expectations

made of them and adjusted behavior accordingly. Removal of children from settings was observed when their behavior was considered inappropriate and they were placed in another setting as a "time-out" arrangement. In this instance, a child whose behavior pattern did not conform to standing patterns of behavior associated with the setting was removed from the area. In this way, social and physical forces work together to influence behavior.

Social Interaction

The majority of the social interactions were of a group nature and this was consistent across room, density conditions, and sex and age groupings. Solitary and parallel play showed more variety. The amounts of solitary and parallel play in Room B and Room C were equivalent and ranged from 9.7% to 13.3% of the observations made. A different pattern was found in Room A where there was approximately 10% more parallel play than solitary play. The amount of solitary play noted in Room A was slightly less than that found in the other rooms while the amount of parallel play was approximately 7% more than that found in Rooms B and C.

Several differences based on age and sex groupings were noted in the social interaction patterns, though these patterns were not consistent between rooms. In Room C, males engaged in more group and less solitary play than females, while in Room B, males were involved in less group play and more solitary play than females. There were no differences in the amount of solitary play. In Room A, there were no differences based on sex. With regard to age differences, in Room A, older children spent more time in group play and less time in

parallel play than younger children. In Room B, older children engaged in less solitary play, and more group play than younger children. There were no differences in the amount of parallel play. There were no differences based on age in the social interactions of Room C.

Explanations which would account for the difference in findings may not lie with the physical environment, which was similar in all rooms. The major difference was in the amount of space during Time 2, and the results presented here have not been able to substantiate any direct influence of a smaller spatial area on the behavior of the children. There were several other factors which differed and might have influenced the findings. Each group studied was a unique combination of children and staff members which has established a working social relationship based on the characteristics of each individual. Influencing the type of patterns established would be idiosyncratic patterns of behavior exhibited by individuals, interdependent activities of small groups, and the expectations and activities of the staff.

Individual patterns of behavior were found to differ substantially and highly idiosyncratic behavior was noted in social interactions. This may suggest that individual characteristics have a mediating effect on environmental factors such that the behaviorial response to environmental stimuli is unique. The idiosyncratic behavior of the individual children discussed in the findings is an example of how personal characteristics mediate the influence of environment factors. The two children described showed markedly different patterns of behavior than their peers and it is suggested that two factors were significant in influencing their behavior. First, the children were new to the program. McGrew and McGrew (1972) studied the behavior of

newcomers to a nursery school program, and found significant differences in their behavior patterns during the initial introduction to the group as compared to children who had attended for a longer period of time. They found that by the end of first week these children had established normal spacing patterns. The children in question in this research study showed abnormal behaviorial patterns which lasted for the duration of the study period. This may be due to the second factor which was that neither child was fluent in English. This would undoubtably hinder the development of social relationships and that, in turn, would affect patterns of setting usage.

The highly individual behavior displayed by these children raises questions with respect to findings of studies which use small samples. Specifically, when conclusions as to the effects of environmental change on sub-groups within the sample, such as sex and age groups, are based on small numbers of subjects, they may easily be influenced by idiosyncratic patterns of individual children.

The behavior exhibited by each child is not developed in isolation but is the product of external factors such as the behavior patterns of playmates as well as individual personality characteristics. In this way the behavior of individual children may not be a response to physical environmental stimuli, but may be influenced by the mediation of group activity.

Smith and Connolly (1976) point out the dangers of analyzing findings by individual child as children's behavior is not independent but strongly influenced by peers, and, particularly, those who have been chosen as playmates. The only means of avoiding

both the problem of individual idiosyncratic patterns of behavior affecting group results, and the influence of peers on individual results, would be to study a large number of groups. By using a sufficient sample, the problem of unique behavior patterns may be minimized. On the other hand, each group may be unique. However, these three groups did reveal considerable similarity in some respects. Some behaviors may be more amenable to comparisons than others.

The influence of the teacher on children's choice of activity is substantial. Featherstone (1974) found that certain children were always located in settings in which teachers participated actively with the children. Others were rarely found in those settings. The presence or absence of an adult may be a factor considered when setting choice is made. Because the staff members in each room are the central decision makers when room and settings rules and expectations are determined, they influence which children will choose each setting according to the needs which can be met in the setting. If the expectations are such that a child feels he cannot meet them he may avoid choosing that setting. In this way staff may indirectly affect setting usage. Because certain social behaviors may occur most often in some settings, social interaction may be influenced as well.

B. Implications for Further Research

This study has left many unanswered questions and has focused on several areas which require further research. Following are areas in which more information is needed and questions which require more study:

1) The findings presented here indicate that the relationship

between man and the environment is complex, and not simply unidirectional. A change in the amount of space could not be associated directly with behaviorial changes. A replication of this study which was able to increase the density to the desired level, as well as other density levels which have been cited as having relevance to this question, would add valuable insights into the question of whether critical density levels do exist. Research which was able to separate the effects of social and spatial density may be able to contribute information which would aid in deciding whether actual amount of space or group size are significant factors in determining behaviorial responses of children. Studies which use pre-formed, operating groups have difficulty ensuring that only the planned changes occur.

2) As man-environment relationships are interdependent, it may be useful to study questions in the area from two perspectives. It appears that increased density becomes important when an individual feels crowded. To determine optimum density levels for pre-school groups, investigation of varying density from both the objective and subjective perspectives is needed. This approach may also allow an investigator to focus on individual responses to environmental stimuli. The problem which Massing (1977) discovered is that young children may have only partially developed spatial constructs and thus may be unable to communicate their preceptions of the spatial environment.

3) The room scan methodology was able to provide reliable information as to children's use of space and activities within the space. It appears to be a useful tool in gathering data related to spatial environments and is flexible enough to be able to focus on various types of behavior. In further research on children in relation

to space, modifications of the categorization system should be considered to provide more distinct pieces of information, and perhaps to provide additional categories of behavior which may be related to environmental stimuli, for example, agonistic behavior.

4) This study was a response to Massing's (1979) recommendation that data collected over a longer period and over a larger number of children would provide more accurate information with regard to children's spatial relations. The implications which result from this study may be that still more time and more children are necessary. A longer period in the compacted condition may be necessary to allow children to adapt to the new condition. A longer time period may eliminate the inconsistent patterns which were found within seven weeks, but which were minimal after a year. Larger samples may negate the effects of highly idiosyncratic behavior exhibited by individuals which may unduly affect group means.

5) Investigation into individual responses to variations in density with regard to specific personality characteristics may be valuable in providing children with environments which suit personal needs. It may be that children who are well adjusted socially and emotionally are better able to adjust to high density situations than children with behaviorial problems.

6) Different responses to environmental conditions such as density by children in full day and half day preschool programs should be investigated. As much of the research into density has used children in nursery school programs as subjects, a comparison of responses from both types of programs would enable one to make judgements as the applicability of research in half day programs to full day programs

and vice versa.

C. Implications for Day Care Practice

The findings which have relevance to day care practice are discussed below:

1) No definitive information was discovered which could lead to the establishment of an optimal space/child ratio. The findings do indicate that behavior differences are not found within a density range of 3.5 - 6.2 m^2/child. No information as to the effects of higher density levels was obtained. Desirable behaviorial patterns may be maintained in a smaller space with a corresponding reduction in the number of children who use the space. Total amount of space may not be as important as the ratio of space to child.

2) When working in a smaller spatial area, it is important that the effect of setting organization be considered in determining children's behavior. Centers which induce a variety of behaviors should be included to provide children with opportunities for solitary, parallel, and group pursuits. Settings should be chosen to respond to needs of the age and sex of children served. Also to be considered is the appropriate organization of settings to accommodate the behavior expected within the setting. Size and equipment organization may affect the types of behavior which occur in settings.

3) The response of teachers/staff members to density of the room should be considered. High density conditions may induce more directive behavior from staff members. Increased tension, fatigue, and irritation may alter staff-child relationships.

4) Individual characteristics of children should be considered

when planning day care environments. Different needs of individuals may require different types of space. A wide variety of spatial settings will ensure that children are able to make selections according to their individual needs.

Research on the influence of the spatial environment on young children is necessary in order to determine optimal environmental conditions which are conducive to encouraging children's growth and development. This study is not able to state optimal density levels though it does suggest some research questions which would provide valuable information with regard to the effects of density. No information was obtained in this study which would suggest that density levels greater than 3.5 m^2/child would be suitable for the encouragement of desired behaviors of children in full-time day care centers. It is hoped that this study will stimulate further research in search of information which may suggest an optimum density ratio.

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APPENDIX A

APPENDIX A

GLENGARRY PROJECT - STAFF INTERVIEWS

The six female staff members from the two experimental rooms were interviewed using an open-ended discussion format, which was recorded on audio-tape. The staff members were asked to comment on children's use of space, changes made in programming due to the smaller spatial area, changes in the children's social and emotional reactions, staff reaction to the smaller spatial area, and changes noted in staff-child relationships during Time 2. Finally, staff members were asked to speculate on programming changes they would implement if they were working in a permanently smaller space. The responses for these questions made by the dare care staff in the two experimental rooms are summarized in the following section.

Use of Space

Staff members in both rooms commented that the Block Area and the House Area were used less frequently in Time 2 than in Time 1. This information was supported for the Block Area in Room B by the room scan data but not for the other areas. It was also noted that there was not enough space for large motor activities such as dance and games. For the Book/Music Area, a story time or any time a large group was gathered, the children were sitting so close together it was uncomfortable. One staff members described seating arrangements during these periods as being in "layers". In Room B, a staff member

noted that the children played less on the floor and more at the tables because "they were afraid of being stepped on." Two staff members in Room A observed that the children were climbing on top of cupboards and under tables more in Time 2, and surmised that this may be an attempt to find a place of their own. A Room B staff member suggested that the children used the Book/Music Area more during Time 2 as it was a place where one could have a "private space." The room scan data showed an increase in the use of this setting during Time 2 but there was no increase in the amount of solitary play in this setting.

Program Changes

Because of the reduced spatial area, staff members in both rooms stated that activities which involved large groups were avoided, as well as simultaneous small group work where several small groups were working within the day care room. In Room B, staff members cancelled themes because lack of space restricted the type of activities which could be set out. Several staff in this room noted that increased planning was necessary. They also spent more time tidying the room.

Social and Emotional Responses of Children

All staff members commented that there was an increase in the number of arguments and fights that occurred during Time 2. One staff member in Room A suggested that while the children still played together, their interactions consisted of more verbal and physical aggression. The Block Area seemed to be particularly frustrating in the limitations imposed by lack of space in the type of construction

activities that could occur. It was noted in this area, that the older children appeared to adopt this area as their own during Time 2, and excluded the younger children from this area. This observation was not confirmed by the room scan data which showed an increase in the use of the Block Area in Room A and a decrease in the use of the Block Area in Room B by both older and younger children.

According to staff members in Room A, certain children became more disruptive during Time 2. Older children were seen to be more aggressive in the smaller area. Others, who were described as needing consistent limits, became involved in more disputes. Regression in specific children's ability to cope with problems was noted. A Room A staff member commented that children with low frustration levels and highly active children appeared to be affected the most by the smaller spatial area. They became more agitated and there may have been a spin off effect from these children to those who were better able to adapt to the smaller space. This "ripple effect" pattern was described by several staff members in both rooms. It was noted that arguments and disagreements quickly spread from the initial participants to include children in the immediate area.

Another change during Time 2 which was noted by all staff members was an increase in the noise level. The room was described as hectic, busier, and noiser.

Staff Reaction

While the staff members were unanimous in their preference for the larger area, a range of reactions were described from those who stated that they "didn't mind" the smaller space, to those who said

they "didn't like it at all." Positive comments focused on the greater awareness of children's activities due to the close proximity of the children to the staff. Most frequent comments were that the smaller space was more tiring as it kept the staff busier and the atmosphere was more tense. Feelings of irritation were described and in several cases atrributed to the higher noise levels. Feelings of being "hemmed in", "caged", and "cramped" were noted. One staff member felt that over an extended period, the smaller space would lead to less patient interactions with children and a higher staff turnover.

Staff-Child Relationships

The relationship between staff and children was generally described as more directive. The staff intervened in disputes sooner and more often than usual in order to stifle the ripple effect described earlier. Children did not seem to be able to work out their own problems and requested more adult assistance. Several staff members noted that there was more tattling in the smaller spatial area. One staff member in Room B suggested that more direction was also given children in terms of activities selected. Staff members reported that they were more irritable with the children and one staff member noted that while staff-child interactions increased during Time 2, "they were not always of the positive kind."

Program Alterations for a Smaller Spatial Area

The staff were asked to comment on changes they would make if the room size was to be permanently reduced. All staff members in

both rooms suggested that some furniture and equipment would have to be removed. It was also suggested that multi-purpose furniture and "scaled-down" furniture would be substituted. Several staff stated that fewer activities would be available at one time and activity areas would be set up on a rotating basis. It was noted that the program would have more whole group activities, more "sit-down" work and less free play. Children might have to be directed more and would have a more limited choice of activities. One staff suggested that the program would have to be "more rigid."

Comments made by the day care staff add an extra dimension to the understandings developed on the effects of the change in spatial area. The subjective nature of the comments provide additional insights into behavior which were not coded by the room scan. The experience and knowledge of the staff may provide a broader and more accurate basis for comparing the two spatial conditions.

APPENDIX B

Individual Social Interaction Data for Children in Room A
for Three Time Periods

Child Number	Social Interaction Categories														
	Solitary Time			Parallel Time			Group Time			Watching Time			Transition Time		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
19	1	5	2	8	17	17	88	73	72	0	1	2	0	0	2
8	14	19	17	13	21	18	65	53	59	2	3	2	1	0	2
7	9	2	1	13	17	6	73	77	89	0	1	1	1	0	0
16	5	4	3	14	14	6	77	77	86	1	2	1	1	1	1
3	9	4	9	15	22	17	69	67	68	2	1	1	2	3	1
5	11	7	6	16	26	23	65	60	63	2	1	5	2	2	0
10	11	7	18	20	20	17	59	61	49	6	9	12	1	1	1
9	16	13	19	23	31	25	50	47	44	7	5	6	0	0	1
20	6	3	6	10	14	7	79	80	82	3	0	3	0	0	0
6	7	4	7	10	13	11	75	74	77	4	4	3	1	2	0
1	5	14	26	23	26	29	40	44	33	28	11	6	1	1	1
2	3	3	5	21	20	17	68	67	67	3	5	5	1	1	3
14	8	6	10	17	22	16	71	67	70	0	2	1	1	0	0
15	10	9	7	18	21	20	63	60	66	4	4	3	0	1	1
12	13	9	17	26	27	25	52	58	51	2	0	1	3	2	2
Mean	8.7	7.5	10.4	16.7	20.9	17.1	66.5	64.5	65.3	4.3	3.5	3.7	1.2	1.1	1.2
Low Score	1	2	1	8	13	6	40	44	33	0	0	1	0	0	0
High Score	14	19	26	26	31	29	88	80	89	28	11	12	3	3	3

Individual Social Interaction Data for Children in Room B
for Three Time Periods

Child Number	Social Interaction Categories														
	Solitary Time			Parallel Time			Group Time			Watching Time			Transition Time		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
9	12	7	12	10	10	5	71	76	75	1	1	1	2	2	4
5	11	15	6	16	15	7	68	60	79	1	3	0	3	4	5
7	9	13	27	9	18	6	73	62	58	3	1	2	3	3	4
6	8	10	13	12	16	9	70	64	72	2	3	1	4	4	2
14	8	23	11	10	21	9	42	49	67	5	2	4	0	1	5
7	24	45	41	15	20	8	51	25	42	6	4	0	1	4	5
18	12	4	18	14	21	11	51	67	64	18	3	1	2	2	2
3	15	15	10	15	10	6	63	68	77	1	1	0	2	3	3
15	15	6	5	13	13	13	66	75	78	1	1	0	1	1	2
13	10	9	18	12	8	6	71	80	67	3	1	0	1	1	4
16	3	4	7	9	6	7	83	84	79	1	3	2	0	0	3
12	19	9	17	13	19	11	56	60	58	6	7	7	2	1	4
Mean	12.4	13.5	15.6	12.5	15.0	8.4	66.5	64.3	68.2	4.2	2.7	1.8	2.0	2.4	3.8
Low Score	3	4	5	9	6	5	42	25	42	1	1	0	0	0	2
High Score	24	45	41	16	21	13	83	84	79	18	7	7	4	4	5

Individual Social Interaction Data for Children in Room C
for Three Time Periods

Child Number	Social Interaction Categories														
	Solitary Time			Parallel Time			Group Time			Watching Time			Transition Time		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
3	13	6	2	13	17	1	65	65	89	2	7	7	3	1	0
12	0	6	4	11	14	4	80	73	81	0	2	2	5	2	5
6	10	9	9	6	7	11	78	82	75	1	1	1	2	0	1
17	6	3	4	20	14	7	65	78	81	1	1	1	4	1	3
1	4	6	8	17	9	12	69	79	74	1	1	2	4	3	2
8	10	15	3	13	11	14	70	65	79	3	3	2	1	3	0
15	4	3	3	9	5	1	79	86	90	1	1	1	3	2	4
2	6	11	8	9	13	3	79	68	78	3	4	3	3	1	4
13	3	4	2	8	7	2	81	79	89	0	1	0	3	5	4
4	20	13	11	12	16	5	54	59	68	8	6	7	3	2	3
20	11	4	28	12	9	3	70	77	59	1	3	0	1	3	4
9	31	22	19	11	22	0	49	50	70	2	3	5	2	1	2
10	2	7	5	10	10	5	75	70	82	5	7	0	5	2	4
7	5	7	5	10	10	14	79	72	76	2	3	0	1	2	1
18	11	8	17	16	7	4	58	70	69	9	6	1	2	4	2
16	25	25	19	23	12	18	49	56	47	1	0	9	0	4	2
Mean	10.3	9.5	9.4	12.7	11.6	6.7	68.8	70.9	75.8	2.7	3.3	3.1	2.8	2.5	2.8
Low Score	0	3	2	6	5	0	49	50	47	0	0	0	0	0	0
High Score	31	25	28	23	22	18	81	86	90	9	7	9	5	5	5